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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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Memorandum

SUBJECT: **REVISED Thiophanate-methyl**: Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision Document.

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This is a revised exposure and risk assessment and reflects changes made in response to the thirty day error-only registrant review.
Note: Thiophanate-methyl has a toxic metabolite known as MBC or carbendazim, which is shared with an another fungicide, benomyl. Separate occupational risk assessments were written for these three registered pesticides. The Health Effects Division (HED) is currently developing policies to address cumulative exposure to chemicals with the same mechanism of toxicity, so this issue is not addressed in this document.

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EXECUTIVE SUMMARY

Background

Thiophanate-methyl ([1,2-phenylene)-bis(iminocarbonothioyl)]bis[carbamate]) is a systemic fungicide registered for use in a wide variety of agricultural, ornamental, and residential settings. There are six manufacturers of thiophanate-methyl products with 36 active registrations and 22 state special local need (SLN) registrations. Major food/feed crops include: almonds, apples, dry beans, green beans, peaches, potatoes (seed pieces), soybeans, strawberries, sugar beets, and wheat. Non-agricultural uses include ornamentals, turf (sod farms, residential, and recreational lawns), greenhouses, interiorscapes, landscaping, and nursery use (including bulb dip treatment). There is a potential for exposure from agricultural, commercial operator, and residential uses. Therefore, both occupational and residential exposure assessments were conducted.

Hazard Profile: Thiophanate-methyl

A review of incident data sources found that relatively few incidents were reported.[1] The majority of significant symptoms were respiratory or eye irritation, particularly when handling dry formulations. Eleven of 37 California incident reports were judged related to thiophanate-methyl alone, and the majority of the five systemic illnesses occurred due to a crew of workers sprinkling thiophanate-methyl from coffee cans onto potato seed pieces. Symptoms included shortness of breath, chest pains, burning eyes, dizziness, and fatigue. The Office of Pesticide Program (OPP) Incident Data System cited 2 incidents in 1994, both of which were reportedly a result of spray drift. One case reported respiratory irritation, the other eye irritation, with no follow up information. Thiophanate-methyl was not included on the list of the top 200 chemicals for which the National Pesticide Telecommunications Network (NPTN) received calls from 1984-1991. Thiophanate-methyl was not one of the 28 chemicals for which Poison Control Center data were requested.

In accordance with the EPA Proposed Guidelines for Carcinogen Risk Assessment (April 10, 1996), the Hazard Identification Assessment Review Committee (HIARC) classified thiophanate-methyl as "likely to be carcinogenic to humans" by the oral route based on weight-of-the-evidence considerations.[2] The linear low dose cancer risk Q_1* is 0.0138 $(mg/kg/day)^{-1}$. Therefore, a cancer risk assessment was conducted. The lifetime average dermal and inhalation exposures are aggregated for the cancer risk estimate.

The non-cancer toxicological endpoints that were used to determine short- and intermediate-term incidental oral and short- and intermediate-term inhalation risk estimates were based upon decreased maternal body weight and food consumption seen in a rabbit oral developmental study, as reported by the HIARC[3]. An oral NOAEL of 10 mg/kg/day is used for inhalation with an absorption factor of 100 percent. The non-cancer short- and intermediate-term dermal risk estimates are based on decreased body weight and consumption seen in a 21-day dermal toxicity study in rabbits. A dermal NOAEL of 100 mg/kg/day is used for these assessments and no dermal absorption factor is needed. The incidental oral, dermal, and inhalation short- to

intermediate-term exposures may be aggregated because the toxicity endpoints selected were based on the same effects. The non-cancer long-term dermal and inhalation risk estimates are based on decreased body weight and thyroid effects seen in a one-year dog feeding study. An oral NOAEL of 8 mg/kg/day is used for these assessments with a dermal absorption factor of 7 percent and an inhalation absorption factor of 100 percent.

For thiophanate-methyl, the level of concern established by the HED for occupational non-cancer risks is a margin of exposure of 100. This may also be described as the "target MOE." Risk estimates with MOEs less than 100 exceed the level of concern for thiophanate-methyl. Due to an incomplete toxicological database, the target MOE for non-occupational exposures to thiophanate-methyl is 300.

Hazard Profile: Carbendazim (MBC)

Thiophanate-methyl also has a toxic metabolite of concern: Carbendazim or MBC. Studies of dislodgeable and transferable residues, as described in Section 2.2.2, show that the MBC residues are initially very low relative to thiophanate-methyl and only approach the level of the parent several days to weeks (if ever) after application. Therefore, MBC exposure is not anticipated during mixing, loading or application of thiophanate-methyl formulations, but exposure is possible for persons contacting treated surfaces. MBC is also a metabolite of another fungicide, benomyl. Separate toxicological endpoints were determined for MBC by the benomyl HIARC.[4] An oral NOAEL of 10 mg/kg was selected for short- and intermediate-term dermal exposures, based on decreased body weight gain and food consumption in the fetus and skeletal malformations in the mother in a rat developmental study. This oral endpoint is also used for children's short-term incidental oral exposures. A NOAEL of 10 mg/m^3 (0.96 mg/kg) was selected for inhalation exposure of any duration, based on nasal effects seen in a rat inhalation study. Dermal and inhalation doses cannot be aggregated because of the different toxic endpoints selected for each of these exposure routes. A dermal absorption factor of 3.5% was assigned based on a benomyl rat study. A separate exposure and risk assessment will be conducted for MBC. Carbendazim/MBC is also classified as a possible human carcinogen based on the presence of liver tumors in mice following dietary exposure. The cancer Q_1^* for MBC is 2.39×10^{-3} $(mg/kg/day)^{-1}$.[5] The occupational target MOE is 100 (10x intraspecies, 10x interspecies) and the non-occupational (residents, public) target MOE is 1000, due to an additional 10x Food Quality Protection Act (FQPA) factor for increased fetal susceptibility following in utero exposure to MBC in rats and rabbits. MBC and thiophanate-methyl exposures are not aggregated in this assessment because of differences in toxic effects.

Exposure and Risk Assessments for Occupational Handlers: HED anticipates that thiophanate-methyl occupational handler dermal and inhalation exposures will only occur in either a short-term or an intermediate-term pattern (less than seven days up to several months). Long-term (several months to year-round) handler exposures are not anticipated. Handler exposure to MBC is not anticipated. Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the reregistration of thiophanate-methyl. It is the policy of the HED to use surrogate data from the

Pesticide Handlers Exposure Database (PHED) Version 1.1 to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.[6] The PHED is currently being updated using proprietary data submitted by the Outdoor Residential Exposure Task Force (ORETF), and some ORETF data are used in this assessment.[7] The anticipated use patterns and current labeling indicate 25 major occupational handler exposure scenarios. Published data (Fenske et al., 1991) were used for scenarios (5) loading dusts for potato seed piece treatment and (22) loading/applying dust as a seed treatment.[8] Published data (Stevens and Davis, 1980) also were used for scenarios (5) loading dusts for potato seed piece treatment, and (13) applying dusts for potato seed piece treatment.[9] No data are available to assess risks for scenario (12) applying as a dip, or (17) mixing/loading/applying dry flowables using a low pressure hand wand [although exposure in the latter scenario is expected to be no greater than the same activity using wettable powder, for which surrogate data were used in scenario (15)]. The remaining handler scenarios were assessed using PHED and ORETF data.

Non-cancer Risk Estimates For Occupational Handlers: Short- and intermediate-term non-cancer risks are estimated for each of the handler scenarios identified for thiophanate-methyl where exposure data are available. Since the toxicological effects from short- and intermediate-term dermal and inhalation exposures are similar, the non-cancer risk estimates from dermal and inhalation exposures are aggregated in this assessment. Non-cancer risk estimates are assessed using the maximum application rate for each crop or use-pattern and HED standard values for the number of acres treated (or gallons handled) per day (A/day). The risks initially are assessed assuming handlers are using baseline attire (i.e., long-sleeve shirt, long pants, shoes, and socks). If risk estimates exceed the level of concern for a given scenario with baseline attire, then risks are assessed with the addition of personal protective equipment (i.e., chemical-resistant gloves, double-layer body protection, and/or a respirator) as required. In general, the HED uses the least PPE necessary to achieve risk estimates that do not exceed the level of concern. Also, if the risk estimates for *inhalation* exposures result in a MOE that is at least two-fold greater than the target MOE (i.e., MOE $\geq$ 200) at baseline (no respirator), then the inhalation exposures will not contribute significantly to an aggregate (dermal + inhalation) MOE. Therefore, addition of PPE, and/or a respirator, is not warranted for that scenario. If the risk estimates exceed the HED's level of concern (i.e., MOE < 100) for a given scenario even with the addition of PPE, then the risks are assessed with the use of engineering controls (i.e., closed system mixing/loading and enclosed cabs or cockpits for applying and flagging).

The short- and intermediate-term non-cancer risk estimates for dermal and inhalation exposures of occupational handlers at baseline attire, with the addition of PPE, and with the addition of engineering controls are summarized in Table 5. Overall, about half of the baseline exposure scenarios had MOEs $\geq$100; 90% when maximum PPE were added, and all MOEs were $\geq$100 when engineering controls were added, if feasible. Where data for baseline exposures were available, either from PHED, ORETF, or published literature, in general risk estimates did not exceed the level of concern (*except* when application rates exceed 10 pounds active ingredient per acre (lbs ai/A)) at baseline attire for:

- mixing and loading dry flowable formulations,
- loading granular formulations,

- applying with any equipment,
- mixing/loading/applying with any equipment, and
- flagging to support aerial applications.

For mixing and loading wettable powder formulations to support aerial or chemigation applications, engineering controls (i.e., water-soluble packaging) are required to achieve the target MOE for many crops and use patterns. In general, for the remaining handler scenarios, the addition of PPE resulted in risk estimates not exceeding the level of concern, *except* in a few instances where application rates exceed 10 lbs ai/acre. The addition of gloves to baseline protection increased MOEs to $ 100 for most (83%) of scenarios, but further addition of respirators and coveralls only increased the number of scenarios with MOEs $100 to 90%. The MOEs were less than 100 for the highest application rate for loader/applicators using push-spreaders and belly grinders, and no feasible engineering controls are available.

Cancer Risk Estimates for Occupational Handlers: Cancer risks were estimated for the various handler scenarios using two categories of handlers: private and commercial. "Private" handlers are assumed to mix, load, apply, or otherwise handle thiophanate-methyl as part of their duties on a single agricultural establishment of a typical size. "Commercial" handlers are assumed to be either custom "for-hire" applicators or individuals who handle thiophanate-methyl on a very large agricultural establishment. The HED assumes that private handlers would handle thiophanate-methyl less frequently than commercial handlers. Except where specific information is available (such as with greenhouses and golf courses), commercial handlers are assumed to handle thiophanate-methyl ten days for each one day that private handlers are assumed to handle it. When available, EPA used the average or "typical" application rate for assessing cancer risks, since the assessment is based on a lifetime of exposure. In general, EPA considers occupational cancer risk estimates greater than one in ten thousand (10^{-4}) to be of concern, and attempts to mitigate occupational exposures so that cancer risk estimates are one in one million (1×10^{-6}) or less, where feasible. Table 5 summarizes the estimated cancer risks to private and commercial occupational handlers for each of the handler scenarios with baseline attire, with the addition of PPE, and with the addition of engineering controls. At baseline, most of the exposure scenarios had estimated cancer risks less than 10^{-4}, but greater than 10^{-6}. Cancer risk estimates at baseline for private and commercial handlers range from 9.4×10^{-4} to 3.1×10^{-9}, and from 9.4×10^{-3} to 9.2×10^{-9}, respectively. With the addition of PPE, cancer risk estimates for all private handler scenarios and most commercial handler scenarios were less than 10^{-4}. When PPE is added to scenarios with baseline cancer risk estimates greater than 10^{-6}, risk estimates for private and commercial handlers ranged from 5.5×10^{-5} to 1.2×10^{-8}, and from 5.5×10^{-4} to 2.2×10^{-7}, respectively. With the addition of engineering controls, where risk estimates greater than 10^{-6} and where feasible controls exist, cancer risk estimates for all private handler scenarios were equal or less than 10^{-6}, and estimates for commercial applicators ranged from 2.9×10^{-5} to 1.1×10^{-7}. Handler scenarios with high application rates ($ 10 lbs ai/acre), very high acreage crops (i.e., 1200 A/day) or hand-held application equipment generally had cancer risk estimates greater than 10^{-6}, even with the addition of PPE or engineering controls. Most hand application methods (hand-directed sprays, spreaders, etc.) do not have a practical means of enclosure or other engineering control.

Exposure and Risk Estimates for Occupational Postapplication Workers: It is anticipated that short-, intermediate-, and long-term dermal exposures may occur for workers engaged in postapplication activities associated with thiophanate-methyl use patterns. Long-term exposures are anticipated in some use patterns based on very slow dissipation of foliar residues and, in some labels, unlimited period reapplications. Inhalation exposures are not anticipated due to a low vapor pressure and outdoor dilution effects. Both thiophanate-methyl and MBC postapplication exposures are anticipated, but these were not aggregated because of different toxic effects. Post-application risks were estimated for occupational workers using studies submitted by the pesticide registrant, Elf Atochem. Elf-Atochem submitted three dislodgeable foliar residue (DFR) studies that address the dissipation of thiophanate-methyl on apples, strawberries, and cut flowers respectively, and a study of turf transferable residues (TTR).[9,10,11,12] Table 9 summarizes the TTR and DFR values from registrant submitted studies that are used in postapplication assessments.

Except for a greenhouse worker study by Brouwer, et al., no thiophanate-methyl-specific studies were available for estimating transfer coefficients. Standard transfer coefficients were used based on the EPA Science Advisory Council for Exposure guidance on agricultural transfer coefficients (Policy 3.1, 08/07/00). For occupational exposures, an 8-hour exposure day was assumed.

Risk estimates for short- and intermediate-term dermal exposures are assessed based on the DFR data on day 0 or day 1, whichever is greater, and are therefore considered high-end estimates. The current Restricted Entry Interval or REI for thiophanate-methyl is 12 hours. Cancer risk estimates are assessed based on the average DFR data in the range of day 1 to day 14, since in general, thiophanate-methyl can be reapplied at 14-day intervals. This means that if the restricted-entry interval were set at day 1, EPA estimates that workers would enter treated areas on days 1 through day 14, with the average exposure being the average of DFRs between days 1 and 14. If cancer risk estimates are of concern based on the average DFR between days 1 and 14, then risks are assessed using the average day 2 to day 14, day 3 to day 14, etc. This assesses the risks with increasing REIs. In some instances, risk estimates remain greater than 10^{-6} after day 14, which is the usual retreatment interval. In these cases, EPA back-calculated to ascertain what day of entry would achieve cancer risk estimates that were less than 10^{-6}. If the calculations indicate, for example, that cancer risk estimates reach 1.0×10^{-6} on day 30, that means that the *average* or *typical* day of entry is day 30 to reach that risk level. That should not be interpreted as an REI of 30 days, but rather is a range-finder calculation.

Postapplication Risk Estimates for Occupational Workers from Exposures to Thiophanate-methyl: Table 10 presents an overall summary of occupational postapplication risk estimates by crop and worker activity. The risk estimates were considerably higher when residue data from dry (western) versus humid (eastern) climates for apple trees, or from non-irrigated turf versus irrigated turf were used to predict worker risks. The risk estimates for tree crops generally attained a MOE of 100 within one week for most activities when NY data were used, while one to several months were required to attain a MOE of 100 when WA data were used to estimate risks for apples, peaches, grapes, and large ornamentals. High-contact activities on turf required

7 days to attain a MOE of 100 using non-irrigated turf data, but only 2 days using the irrigated turf data. Row crop reentry risk estimates using strawberry DFR data indicated 1 day was sufficient to achieve a MOE of 100 for most tasks, except working with ornamentals. These risk estimates are less certain for crops which do not resemble strawberry plants in architecture and leaf surface. Cut flowers risk estimates, using data for transfer coefficients and residues from thiophanate-methyl studies, showed MOEs of 100 were not attained until 1-2 months after application. Using 14 day average residues, cancer risk estimates for most activities on most crops were between 10^{-4} and 10^{-6}, although some high-contact activities exceeded 10^{-4}, notably those involving cut flowers and woody ornamentals. Insufficient data are available to characterize risks from field sorting and packing, or from digging and transplanting in treated soil.

Postapplication Risk Estimates for Occupational Workers from Exposures to MBC: A worker post-application exposure scenario was also assessed for the metabolite of thiophanate-methyl, MBC. The same assumptions as for thiophanate-methyl were used along with the maximum MBC DFR for each study. The highest MBC DFR value was used because of the uncertainties in the percentage of thiophanate-methyl that degrades to MBC at any time in the environment, as well as the dissipation rate of MBC (which initially increases before decreasing on foliage). Therefore the risk estimates are considered range-finding or conservative. The risk assessment indicates that non-cancer risks to postapplication workers do not exceed the level of concern (MOE >100) from exposures to MBC residues as a degradate of thiophanate-methyl. For short-term risks, the MOEs range from 250 to 630,000 with a target of 100. Table 15 summarizes the exposure and risk estimates. Cancer risk estimates range from 4.4×10^{-6} to 1.9×10^{-8}.

Residential Exposure and Risk Estimates

Potential residential exposures are anticipated as a result of applications of thiophanate-methyl to residential lawns and gardens by homeowners and by professional lawn/ornamental applicators. Applications are made to lawns, ornamentals and "backyard" orchards. Residential exposures have been estimated based on label application frequency, estimated seasonal length, and the persistence of thiophanate-methyl. Handler exposure to MBC are not anticipated. Most assumptions for risk estimation were based on the Residential SOPs (updated 02/01) and the estimates are considered to be screening-level. It is estimated that thiophanate-methyl could be applied up to 5 times in a season to residential turf or ornamentals, either by resident or professional applicators. The registrants submitted information suggesting one application per season is typical. Residential risk estimates resulting in MOEs greater than 300 for exposures to thiophanate-methyl, or greater than 1000 for exposure to MBC do not exceed the HED's level of concern. In general, EPA attempts to mitigate nonoccupational exposures so that cancer risk estimates are one in one million (10^{-6}) or less. Table 16 shows residential handler exposure and risk estimates; Table 4 summarizes the residential postapplication exposure and risk estimates. For the general non-occupational population, a cancer risk estimate of 10^{-6} or less does not exceed HED's level of concern.

Residential Handler Risks: Only short-term (less than 7 days) dermal and inhalation exposures are anticipated for residents applying thiophanate-methyl products. Short-term non-cancer risks and cancer risks to residential handlers were assessed. The assessment uses the revised draft Standard Operating Procedures for Residential Exposure Assessment[14], and includes surrogate data from the PHED and ORETF for applying with a hose-end sprayer and for loading/applying with a push-type granular spreader. Since the toxicological effects from dermal exposures are similar to those from inhalation exposures to thiophanate-methyl, the non-cancer risks from dermal and inhalation exposures are aggregated in this assessment. Handler and postapplication exposure may also be aggregated, if such a scenario is likely.

The risk assessment indicates that non-cancer risks to residential handlers exceed EPA's level of concern for four scenarios involving application to lawns, either by broadcast or spot treatment:

- mixing, loading, and applying liquid with a hose-end sprayer (MOE = 84),
- mixing/loading/applying liquid (MOE = 190) and wettable powder (MOE = 72) formulations with a low pressure (pump) handwand sprayer,
- loading/applying granular formulation with a bellygrinder (MOE = 230), and
- hand dispersal of granules (MOE = 58).

Total exposures for residents applying thiophanate-methyl granular formulations (i.e., weed and feed) via push-spreader or liquid formulations by hose-end sprayer (ready to use) did not exceed the level of concern. Exposures while applying thiophanate-methyl to ornamentals by spreader or sprayer did not exceed the level of concern.

The risk assessment indicates that lifetime cancer risks to residential handlers range from 4.5×10^{-6} to 3.4×10^{-8} for applications to lawns and from 2.5×10^{-7} to 5.2×10^{-9} for applications to ornamentals when the registrant-submitted typical application frequency of once per year is used. While more frequent applications may be necessary in a single season when a heavy infection occurs, other years may require no treatment, and an average of once per year is deemed reasonable for estimating lifetime cancer risks.

Residential Postapplication Risk Estimates: Cancer risks and short- and intermediate-term non-cancer risks from residential postapplication exposures were estimated for thiophanate-methyl and for its degradate, MBC. The scenarios assessed for the purpose of screening-level risk estimates included adults and children performing high-contact play or work activities on treated lawns, adults or youths mowing lawns or golfing, and adults and youths picking fruit from treated trees. Small children were also assessed for incidental oral exposure from hand-to-mouth activities while playing on a treated lawn. Some of these exposures were aggregated, where it was deemed reasonably likely activities would co-occur. Residential risk estimates utilized the submitted residue dissipation studies and turf transfer study, as well as the EPA's original and revised Draft SOPs for Residential Exposure Assessment.[13,14] There is some evidence from the study data submitted that watering or rainfall increases the residue dissipation rate (see summaries of turf TTR study and apple DFR study data). Turf labels variously call for watering or irrigation within 24 hours or less. This instruction, however, does not prevent

contact with turf prior to watering-in. Also, the turf studies cited used typical irrigation practices. For short- and intermediate-term nonoccupational risks, the HED has established a level of concern at MOEs of 300 for thiophanate-methyl and 1000 for MBC.

Postapplication risks resulting from thiophanate-methyl exposures were assessed for adults and children working or playing on treated lawns (Summary Table 4). Adult postapplication exposures include short- and intermediate-term dermal exposures, while postapplication exposures for children include short and intermediate-term dermal and incidental oral exposures. The TTR data provided by Elf-Atochem and transfer rates set forth in EPA's original and revised Draft SOPs for Residential Exposure Assessment were used. The TTR data from the day of treatment (or day after treatment/DAT 0) in the studies were used to assess short-term non-cancer risks and the TTR data from DAT 7 in the studies were used to assess intermediate-term non-cancer risks. Cancer risks were estimated using 14-day average residues for turf to simulate typical exposure between reapplication cycles as well as the duration of turf residues. For fruit picking, DAT 1 and 7 residue data were used for cancer risk estimates, assuming a single seasonal application. Short-term non-cancer risk estimates resulting from dermal contact with treated turf during high contact lawn activities exceeded the level of concern for adults (MOEs range from 140 to 260) and for children (MOEs range from 81 to 160). Intermediate-term non-cancer risks did not exceed the level of concern (ranging from 540 to 13,000) for adults or small children engaged in high contact activities using the data from either irrigated or non-irrigated sites. Estimated cancer risks for adults from performing dermal high contact activities on turf range from 9.6×10^{-7} (PA data) to 3.1×10^{-7} (CA/GA data).

Short-term and intermediate-term non-cancer risks and cancer risks resulting from dermal contact with thiophanate-methyl residues on treated turf during mowing or golfing activities did not exceed the level of concern (MOE > 300) for adults or preteens. Short-term and intermediate-term non-cancer risks and cancer risks resulting from dermal contact with MBC residues on treated turf during mowing, golfing, or high-contact lawn activities did not exceed the level of concern for adults, small children, or preteens (MOEs range 5800-490,000: see Tables 4 and 19- 20).

Current labeling (Cleary 3336F, EPA Reg. 1001-69) permits application to "backyard orchards" up to 24 hours prior to harvest. Although this labeling appears primarily intended for professional use, residents are assumed to harvest fruit, play on lawns, or play golf within the first 24 hours of spraying. Restrictions on early re-entry are impractical and unenforceable for residents. The postapplication residential assessment for home fruit harvesting uses DFR data from the apple study (in which residues varied greatly between the states of New York and Washington). The assessment also uses application rates specific to tree fruit and nut trees, and the revised Residential SOPs. The transfer coefficients for harvesting fruits are higher than for nuts and therefore are used for this screening level assessment. For adults harvesting fruit for approximately 40 min/day, using day of application residue data, only the risk estimates for peaches and almonds, which have the highest application rate, exceed the level of concern (MOEs 210-290, & 240 respectively). For 10-12 year-olds harvesting fruit or nuts for approximately 20 min/day, the risks from exposure to thiophanate-methyl residues do not exceed

the level of concern for all use rates with MOEs ranging from 470 to 1500. The adult cancer risks for these scenarios are based on day of treatment exposure, range from 1.2×10^{-6} to 3.7×10^{-6}, and are at or below 10^{-6} when the 7th day residue is used. See Table 18a for a summary of risk estimates from exposure to thiophanate-methyl during these activities. Short-term non-cancer risks and cancer risks resulting from exposures to MBC residues during adult or preteen harvesting of fruit or nuts do not exceed the level concern. See Table 18b for a summary of risk estimates from exposure to MBC during these activities.

EPA assessed short- and intermediate-term non-cancer risks to small children from incidental ingestion of thiophanate-methyl granules or residues following application to residential lawns (see Table 21a). The level of concern for residential risks is set by the HED at a MOE of 300. The risks do not exceed the level of concern from incidental ingestion of soil containing thiophanate-methyl residues (MOEs range from 10,000 to 18,000), but are of concern for ingestion following hand-to-mouth transfer of residues (MOE=35), for incidental turfgrass ingestion (MOE=140), and for ingestion of granules (MOEs 9 and 31). The small children's combined oral hand-mouth scenarios have a MOE of 28. When these risks are aggregated with dermal exposure to turf, all short-term non-cancer risks exceed the level of concern with MOEs ranging from 21 to 37, and intermediate-term MOEs exceed the level of concern for hand-to-mouth activities (MOE of 35).

Children's oral incidental exposures from the MBC component of turf residues were considered for hand-to-mouth and turfgrass mouthing scenarios (Table 21b). It is considered unlikely that significant MBC exposure would result from soil ingestion or granular ingestion given the dissipation and residue levels of MBC relative to thiophanate-methyl. Only the hand-to-mouth incidental oral exposure estimate (MOE 910) exceeded the target MOE for MBC residential exposure of 1000, but the aggregate risk estimate also had a MOE of 910. The high-contact turf dermal exposure and incidental oral exposures to MBC were added, resulting in an aggregate MOE of 790, which also exceed the HED's level of concern.

Risk Concerns, Data Gaps, and Confidence in Estimates

Data were not available for application of slurry seed treatment or the treatment of seedlings. Some areas of concern in this chapter are the data gaps that prevent the Agency from better characterizing occupational exposure to thiophanate-methyl. Areas of data needs are as follows:

OPPTS Guideline No.	Study		Crop
Handlers:			
875.1100	Dermal exposure:	Outdoor	Mixing/loading/applying WP/DF solution as a seedling or bulb treatment
875.1200	Dermal exposure:	Indoor	Mixing/Loading/Applying wettable powder; greenhouse use
875.1300	Inhalation exposure:	Outdoor	[as above]
875.1400	Inhalation exposure:	Indoor	[as above]

Post-application Workers:

875.2400	Dermal exposure	Handling treated seed & seedlings; sorting, packing crops; cultivating, transplanting in treated soil.
875.2500	Inhalation exposure	" "
875.2600	Biological monitoring	" "
875.2800	Descriptions of human activity	" "

Mixing, loading and applying dry flowable formulation by low pressure hand wand is shown as a data gap, but it is assumed to result in a slightly lower exposure than the same scenario using a wettable powder. By using surrogate study data from PHED, it is assumed that pesticides of similar formulation result in similar exposures when handled in the same manner. Several handler assessments were completed using "low quality" PHED data due to the lack of a more acceptable data. Similar limitations and limits of confidence may be associated with the use of data from other published chemical studies.

Post-application re-entry workers also have risk estimates of concern in some cases. Risks to orchard workers and harvesters, and nursery/greenhouse workers would be of greatest concern due to the extended periods postapplication required to attain the target MOEs. Confidence levels are moderate to high for these exposure scenarios.

Most of the residential scenarios for both non-cancer and cancer health risks exceeded the levels of concern. Some of the most common scenarios, namely playing on lawns, spraying lawns or ornamentals, and picking treated fruit at home, all had risk estimates which exceeded the levels of concern. Only the lower-contact activities, such as mowing, golfing, or using a push-spreader to apply granular formulations consistently had short-term MOEs >300. The risk estimates were based on actual thiophanate-methyl exposure studies which met most of the OPPTS guidelines, so the level of confidence is fairly high. It is assumed that the general public's exposure may not be mitigated by use of increased levels of personal protective gear. Therefore, only engineering controls (e.g., closed systems) or administrative controls (e.g., formulation changes or use rate reductions) are feasible methods of risk reduction.

Thiophanate-methyl: Occupational and Residential Exposure/Risk Characterization

1. BACKGROUND

1.1 Purpose

This document is intended to support the development of the thiophanate-methyl Reregistration Eligibility Decision document (RED) and includes the results of HED's review of the potential human health effects associated with non-dietary exposure to thiophanate-methyl.

1.2 Criteria for Conducting Exposure Assessments

An occupational and/or residential exposure assessment is required for an active ingredient (ai) if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers, such as mixers, loaders and applicators during use or to persons entering treated sites after application is complete. Thiophanate-methyl meets the criteria; although it has a classification as a Category III/IV toxicant, and is not acutely toxic, there is a potential for exposure from agricultural and residential uses. Because there are residential uses and professional application to turf resulting in residential exposure, a residential risk assessment/characterization was completed for this chemical. Occupational handler exposures are anticipated to be of short- to intermediate-term duration (less than seven days to several months) while non-occupational (residential/public) handler exposures are expected to be of short-term (one week or less) duration. Post-application exposures to thiophanate-methyl residues are anticipated to be short- to intermediate-term in duration in most cases for both occupational and residential scenarios, except for certain crops, such as greenhouse plants and strawberries. Usage data from the Biological and Economic Analysis Division (BEAD), the registrants and other sources indicates that thiophanate-methyl is usually applied on a seasonal or intermittent "as-needed" basis when conditions favor the growth of the target fungi.

1.3 Summary of Toxicity Concerns Relating to Occupational/Residential Exposures

Toxicological Endpoints

The toxicological endpoints (effects), the doses and the uncertainty factors that were used to complete this assessment are summarized in Tables 1a and 1b below in order to provide a quick reference to the occupational handler and post-application assessments (based on the November 6, 2000, HIARC Report).

Table 1a. Toxicological Endpoints for Assessing Occupational and Residential Risks for Thiophanate-methyl.

Exposure Scenario	Study	Dose	Absorption	Endpoint	UF (Target MOE) or FQPA SF
Short-term and Intermediate-term Dermal	Dermal toxicity - Rabbit	NOAEL 100 mg/kg/day	not needed	Decreased body weight and food consumption	100 occupational 300 non-occupational
Long-term Dermal	Dog One-Year Chronic Study	Oral NOAEL 8 mg/kg/day	7%	Decreased body weight and thyroid effects	100 occupational 300 non-occupational
Short- and Intermediate-term Inhalation	Rabbit Developmental Study	Oral NOAEL 10 mg/kg/day	100%	Decreased maternal body weight and food consumption	100 occupational 300 non-occupational
Long-term Inhalation	Dog One-Year Chronic Study	Oral NOAEL 8 mg/kg/day	100%	Decreased body weight and thyroid effects	100 occupational 300 non-occupational
Short- and Intermediate-term Incidental Oral Ingestion	Rabbit Developmental Toxicity Study	Oral NOAEL 10 mg/kg/day	100%	Decreased maternal body weight and food consumption	300 non-occupational
Lifetime Cancer Risk [All Populations]	Chronic dietary: mouse	$Q_1^* = 0.0138$ mg/kg/day^{-1}		Liver tumors: male mouse	Not Applicable

[a] Exposure value should be converted to equivalent oral dose using dermal absorption factor of 7% and compared to oral NOAEL.
[b] Inhalation dose adjusted to oral equivalent dose: 100% absorption assumed.

Acute, Short-term, Intermediate-term, and Long-term (non-cancer) Endpoints: Thiophanate-methyl has a category IV acute oral toxicity, category III for acute dermal and inhalation toxicity, and category IV for primary skin and eye irritation. Thiophanate-methyl is a skin sensitizer. The non-cancer short- and intermediate-term dermal toxicological endpoint is 100 mg/kg/day, based on a 21-day dermal toxicity study in rabbits where the effects are decreased

body weight and consumption. No dermal absorption factor is needed, since the endpoint is based on study using dermal dosing. The non-cancer short- and intermediate-term inhalation and incidental oral toxicological endpoint is 10 mg/kg/day, based on an oral developmental toxicity study in rabbits where the effects are decreased maternal body weight and food consumption. The inhalation absorption factor is 100 percent. These effects are considered similar enough to warrant aggregating the short- and intermediate-term dermal and inhalation risks from handler exposures and dermal and incidental oral risks from nonoccupational exposures (postapplication inhalation exposures are not anticipated). The non-cancer long-term dermal and inhalation toxicological endpoints are 8 mg/kg/day based on a one-year chronic oral study in dogs where the effects were decreased body weight and thyroid effects. Long-term risks are also aggregated. For these endpoints, a 7 percent dermal absorption factor and 100 percent inhalation absorption factor are applied.

The target Margin of Exposure (MOE) for occupational exposure scenarios is 100. Due to an incomplete toxicological database, the target MOE for non-occupational exposures to thiophanate-methyl is 300.

Carcinogenicity: The HIARC classified thiophanate-methyl as a probable human carcinogen. A linear low risk cancer Q_1* of 0.0138 was applied. Therefore, a cancer risk assessment was conducted.

Metabolite of Concern [MBC]: Thiophanate-methyl also has a toxic metabolite of concern: Carbendazim or MBC. According to the Environmental Fate and Effects Division (EFED), the parent compound degrades to MBC in a period of hours in the environment. Studies of dislodgeable and transferable residues, as described in Section 2.2.2, show that the MBC residues are initially very low relative to thiophanate-methyl and only approach the level of the parent until several days to weeks (if ever) after application. Therefore only postapplication exposure to MBC is a concern. Exposure via treated turf or fruit trees would be anticipated to be of one to several weeks duration (short- to intermediate-term) based on dissipation in residue study data. A separate toxicological endpoint was determined for MBC by the benomyl HIARC.[4] MBC is classified as category III for acute dermal toxicity and primary eye irritation, category IV for primary skin irritation, acute oral toxicity and inhalation toxicity. Carbendazim is not a skin sensitizer. An oral NOAEL of 10 mg/kg was selected for incidental oral exposures in children and for short- and intermediate-term dermal exposures, based on a rat developmental study. A dermal absorption factor of 3.5% was assigned based on a dermal absorption study in rats using benomyl. A NOAEL of 10 mg/m^3 (0.96 mg/kg/day) was selected for inhalation exposure of any duration, based on a rat inhalation study. The target MOE for occupational exposure to MBC is 100, except for long-term inhalation exposures, which have a target MOE of 300 (long-term inhalation exposure to MBC is not anticipated). For non-occupational exposure to MBC, a target MOE of 1000 is required due to increased fetal susceptibility. MBC is also classified as a possible human carcinogen based on the presence of liver tumors in mice following dietary exposure. The cancer Q_1^* for MBC is 2.39 x 10^{-3} $(mg/kg/day)^{-1}$.

Because of the differences in the toxicological endpoints selected for dermal and inhalation

exposures, dermal and inhalation doses cannot be aggregated. Oral and dermal doses (for children) can be aggregated as the endpoint selected is the same. Postapplication exposures via the inhalation route are not anticipated due to the low vapor pressure of MBC (7.5×10^{-10}), dilution outdoors, and the small quantities of residue found in studies. Cancer risk estimates for thiophanate-methyl and MBC are added together as both chemicals cause similar liver tumors (see Table 4).Table 1b. Endpoints for Assessing Occupational and Residential Risks for MBC (Carbendazim)

Test	Study	Dose	Absorption	Endpoint	UF
Short- and intermediate-term Incidental Ingestion	Developmental toxicity - rat (oral)	NOAEL 10 mg/kg/day[a]	NA	Decreased fetal body weight and increases in skeletal variations and a threshold for malformations in dams	100 for occupational exposures
Short- and Intermediate-term Dermal			3.5%		
Long-term Dermal	2 year oral - dog	NOAEL 2.5 mg/kg/day[a]	3.5%	Histopathological lesions of the liver chronic hepatitis in both sexes of dogs	1000 for residential exposures
Inhalation-Any Duration	90 day inhalation - rat	Inhalation NOAEL= 0.96 mg/kg/day (10 mg/m^3)	100%	Olfactory degeneration in the nasal cavity	
Lifetime Cancer Risk [All Populations]	Chronic dietary: mouse	Q_1* = 0.00239 (mg/kg/day)$^{-1}$	NA	Liver tumors: male mouse	Not Applicable

[a] Since an oral value was selected, 3.5% dermal absorption factor should be used for route-to-route extrapolation.
UF = Uncertainty Factor.

1.4 Incident Reports

A review of incident data sources was conducted for thiophanate-methyl on August 15, 1997 by J. Blondell.[1] The majority of significant symptoms were respiratory or eye irritation. The recommendations were that protection against respiratory and eye irritation be worn, especially when handling the dust or dry formulations. Because few incidents were reported, the review was not updated prior to this occupational and residential risk assessment.

The Incident Data System, included 2 incidents in 1994. In the first, a male was exposed to thiophanate-methyl that was sprayed on school playing fields. After the spraying, the wind blew the chemical towards his garden and exacerbated his emphysema. No further information on the disposition of the case was reported. In the second incident, a woman was exposed to spray drift from thiophanate-methyl from an adjacent orchard. She experienced eye irritation. No further information on the disposition of the case was reported.

Poison Control Center data were examined and thiophanate-methyl was not one of 28 chemicals for which Poison Control Center data were requested.

Detailed descriptions of 37 cases submitted to the California Pesticide Illness Surveillance Program (1982-1994) were reviewed. In 11 of these cases, thiophanate-methyl was used alone and was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. None of the cases were reported to have been hospitalized or had to take time off work as a result of their illness, although five cases were categorized as unknown in this respect. A total of 5 persons had systemic illnesses that involved skin, eye, or respiratory effects or (45.5% of 11 persons). Three of these cases occurred in 1990 and the workers were diagnosed with chemical bronchitis. A total of 3 persons had skin illnesses or (27.3% of 11 persons). Thiophanate-methyl ranked 110th as a cause of systemic poisoning in California.

Spray and dust application methods were associated with the majority of the exposures. The majority of the systemic illnesses occurred due to a crew of workers sprinkling thiophanate-methyl from coffee cans onto seed potatoes that were cut. Symptoms included shortness of breath, chest pains, burning eyes, dizziness, and fatigue. The two eye illnesses occurred due to the workers being exposed to residue from thiophanate-methyl that blew into their eyes. Symptoms experienced were eye irritation which included swollen and burning eyes.

Examination of the top 200 chemicals for which the National Pesticide Telecommunications Network (NPTN) received calls from 1984-1991, inclusively, indicated that thiophanate-methyl was not involved in human incidents. The incident data was not updated from the 1997 review due to overall low incidence of reported health effects from thiophanate-methyl.

1.5 Summary of Use Patterns and Formulations

Thiophanate-methyl products are described in this section. Additionally, available information that describes the manner in which thiophanate-methyl products are applied is provided in this section (e.g. use categories/sites, application methods and application rates).

i. End-Use Products

Thiophanate-methyl ([1,2-phenylene)-bis(iminocarbonothioyl)]bis[carbamate]) is a locally systemic fungicide registered for use in a wide variety of agricultural, commercial (greenhouse, turf, etc.), and residential settings. It is manufactured in Japan by Nippon Soda Company but Elf Atochem has the exclusive rights to sell the product in the United States. The Cleary Company is a formulator of thiophanate-methyl end-products and has provided comments on the reregistration process.

Based on a review (8/10/99) of the Office of Pesticide Programs-Reference Files System (REFS) there are six manufacturers of thiophanate-methyl products with 36 active labels and 22 state labels.

Table 2: Active Labels for Thiophanate-methyl.

Formulation	Percent Active Ingredient	EPA Registration Number
Technical	95	4581-280; 5136-310; 66996-3
Emulsifiable Concentrate	46%	538-183; 1001-69
Flowable Concentrate	46%	**4581-352**; 48234-12; 58185-33
Wettable Powder	15-70%	**4581-288**; 4581-322; 4581-377; 1001-63; 58185-9; 58185-10; 58185-30; 58185-31; 58185-32; CA97003100; MI86000100; SC79003300;
Water Dispersible Granules	18-85%	**4581-372**; 4581-TX-1; 1001-72; 48234-7; 48234-13;
Granular	1-5%	538-88; 538-133; 538-194; 538-217; 538-242; 1001-70; 1001-71; **4581-369**; 58185-23
Dust	2.5-90%	**4581-344**; 7501-32; 7501-149; 7501-157; 7501-178; ME0000100; MN99000700; MT99000400; ND99000800; NE00000100; NJ00000100; OK92000300; OK93000100; OR99000200; OR99001200; OR99005900; TX91000700; TX93000600; WA00000200; WA99000400; WA99001100; WI99000500; WI99001100; WY99000200
Ready-To-Use	3.9%	538-253

Reg Nos. in **BOLD** are registered but not currently in production, according to Elf Atochem**.** All labels were included in the risk assessment.

ii. Mode of Action and Targets Controlled

Thiophanate-methyl is a systemic fungicide used for control of such pests as fusarium blight, leaf spot, and fruit rot.

iii. Registered Use Categories

Based on information supplied by registrants (Elf Atochem 12/98 and Cleary Co.) at meetings with EPA, and on information from the Biological and Economic Analysis Division (BEAD) Quantitative Usage Analysis (QUA) for Thiophanate-methyl, dated November 9, 2000, thiophanate methyl total domestic usage for years 1991-1999 averaged approximately four hundred fifty thousand pounds active ingredient (a.i.) for about seven hundred fifty thousand acres treated. Thiophanate methyl is a fungicide with its largest markets in terms of total pounds active ingredient allocated to soybeans (24%), sugar beets (17%), wheat (11%), dry beans (10%), apples (9%), almonds (8%), and peaches (6%). The crops with the highest percent treated include: peaches (26%), strawberries (21%), apples (14%), sugar beets (12%), almonds (11%), apricots (10%), nectarines (10%), plums (7%), and pecans (6%). Crops with less than 1 percent of the crop treated include peanuts, soybeans, and wheat. Thiophanate-methyl may be used on fall-seeded wheat in Idaho, Oregon, and Washington only. Thiophanate-methyl in dust form is also applied to most seed potatoes before planting (1.1 of the 1.4 million acres grown, per Elf Atochem).[10]

Other uses include ornamentals, turf (commercial sod farms, residential and recreational lawns), greenhouses, interiorscapes, landscaping, and nursery use, including seedling and bulb treatment. Thiophanate-methyl is not a restricted-use pesticide and can be purchased and applied by anyone. Scotts' Turf Builder Plus (538-217; 2% ai) and Scotts Lawn Pro Summer Insect and Disease Control Plus Lawn Fertilizer (538-140; 5.5% ai) granular formulations are labeled specifically for home use. The Fertilizer Plus Fungicide VIII (538-194) granular is "recommended" for use by professional turf managers.

iv. Application Parameters

Application parameters are generally defined by the physical nature of the use site, the physical nature of the formulation (e.g., form and packaging), by the equipment required to deliver the chemical to the use site, and by the application rate required to achieve an efficacious dose, along with seasonal limits to applications. Table 3 contains the crops, application types and rates for thiophanate-methyl.

Table 3: Use Parameters for Thiophanate-methyl

Crop	**Application Type**	**Application Rate, lb ai/acre; Frequency of Application**	**Maximum seasonal application (lb ai or application/season), PHI**
Orchard Crops (e.g., pome fruits, stone fruits, nuts)	Airblast Ground or Aerial (foliar)	0.35-1.6 lb ai/A Apply at 10 to 14 day intervals as needed	max 300 lb ai/acre* (or not specified)
Field Crops (e.g., beets, beans, strawberries, wheat, etc.)	Ground or Aerial (foliar)	0.2-1.4 lb ai/A Apply every 7 to 10 days	4.0 lb ai/A, (or not specified)
Peanuts and Seed Potatoes; greenhouse bulbs	Seed treatment (pre-planting)	0.025 lb ai/cwt seed potato; 0.04 lb ai/cwt peanut seed 0.34 lb ai/100 gal dip Apply Pre-plant	Single use per season
Horticultural/Greenhouse /Turf	Ground or hand spray (foliar); chemigation or drench (soil)	0.5 lb ai/100 gal 0.03-0.87 lb ai/1000 ft^2 RTU & FC: 0.35 lb ai/ = 15 lb/A G: 0.25 lb ai/ = 11 lb/A Apply every 10 to 14 days	Soil drench: no limit* Hort. Foliar: 36 lb ai/acre Turf: no specified limit

This table contains summary data which represents generalized label information
* 300 lb ai/season specified max rate per acre; per use drench rate 37-77 lb ai/acre per Cleary Chemical SMART Meeting information [not on label]
cwt = hundred weight (100 lb of seed)
ai = active ingredient
RTU = Ready-to-Use liquid; FC = Flowable Concentrate; G = Granular

2.0 OCCUPATIONAL EXPOSURES AND RISKS

HED has determined that there is a potential for short- and intermediate-term exposures in occupational settings from handling thiophanate-methyl products during the application process (i.e., mixer/loader, applicator and mixer/loader/applicator). Short-, intermediate-, and long-term exposures are anticipated from entering previously treated areas. As a result, risk assessments have been completed for occupational handler and postapplication scenarios.

2.1 HANDLER EXPOSURES AND RISKS

2.1.1 Handler Exposure Scenarios

HED has determined that exposure to pesticide handlers is likely during the occupational use of thiophanate-methyl in agricultural environments, greenhouses, nurseries, turf farms, and by lawn care professionals. The anticipated use patterns and current labeling indicate 25 major occupational exposure scenarios based on the types of equipment and techniques that can potentially be used to make thiophanate-methyl applications. These scenarios serve as the basis for the quantitative exposure risk assessment developed for occupational handlers. These scenarios include:

(1a) mixing/loading of wettable powder (WP) formulation for aerial application and chemigation;
(1b) mixing/loading of WP formulation for groundboom applications;
(1c) mixing and loading of WP formulation for airblast spray application;
(1d) mixing/loading of WP formulation for lawn handgun application;
(1e) mixing/loading of WP formulation for dip application;
(2a) mixing/loading of dry flowable (DF)/water dispersible granules (WDG) formulation for aerial application and chemigation;
(2b) mixing/loading of DF/WDG formulation for groundboom applications;
(2c) mixing and loading of DF/WDG formulation for airblast spray application;
(2d) mixing/loading of DF/WDG formulation for lawn handgun application;
(2e) mixing/loading of DF/WDG formulation for dip application;
(3a) mixing/loading of liquid flowable concentrate (FC) formulation for aerial application and chemigation;
(3b) mixing/loading of liquid formulation for groundboom applications;
(3c) mixing and loading of liquid formulation for airblast spray application;
(3d) mixing/loading of liquid formulation for lawn handgun application;
(3e) mixing/loading of liquid formulation for dip application;
(4a) loading of granular formulation for aerial application;
(4b) loading of granular formulation for tractor-drawn broadcast spreaders;
(5) loading dusts for seed and seed piece treatment;
(6) applying sprays with aerial equipment;*
(7) applying granulars with aerial equipment;*
(8) applying sprays with groundboom equipment;
(9) applying sprays with airblast equipment;

(10) applying sprays with a handgun sprayer;
(11) applying granular formulations with broadcast spreaders;
(12) applying dip treatment;
(13) applying dust to seed pieces;
(14) mixing/loading/applying liquids using high pressure handwand equipment;
(15) mixing/loading/applying WP using low pressure handwand equipment;
(16) mixing/loading/applying liquids using low pressure handwand equipment;
(17) mixing/loading/applying DF/WDG using low pressure handwand equipment;
(18) mixing/loading/applying using backpack equipment;
(19a) mixing/loading/applying liquids using handgun equipment (ORETF data);
(19b) mixing/loading/applying DF/WDG using handgun equipment (ORETF data);
(19c) mixing/loading/applying WP using handgun equipment (ORETF data);
(20) loading/applying granular formulations with belly grinder;
(21) loading/applying granular formulations with a push-type spreader (ORETF data);
(22) loading/applying dust for seed treatment;
(23) mixing/loading/applying a dip treatment;
(24) flagging aerial spray applications;
(25) flagging aerial granular applications.

* PHED contains insufficient data points for rotary-winged aircraft applications, therefore aerial application in this assessment is assumed to be by fixed-wing aircraft only.

2.1.2 Data and Assumptions for Handler Exposure Scenarios

Calculations/Endpoints Used in the Exposure/Risk Assessment

A series of toxicological endpoints were used to complete the handler and postapplication risk assessments. The specifics for calculating handler and postapplication exposures differ because of the way the data for each scenario are presented. As such, the doses and equations that have been used to calculate exposures/risks for all scenarios are presented in this section.

Handler exposure assessments are completed by HED using a baseline exposure scenario and, if required, increasing levels of risk mitigation (personal protective equipment or "PPE" and engineering controls) to achieve an appropriate margin of exposure (MOE). Daily dermal and

inhalation exposures, dose levels, and risks to handlers were calculated as described below. The first step is to calculate daily dermal and inhalation exposure using the following:

$$\text{Daily Dermal Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) = \text{Unit Exposure}\left(\frac{\text{mg ai}}{\text{lb ai}}\right)*\text{Rate}\left(\frac{\text{lb ai}}{\text{Acre}}\right)*\text{Daily Treated}\left(\frac{\text{Acres}}{\text{day}}\right)$$

Where:

Daily Dermal Exposure = Amount deposited on the surface of the skin that is available for dermal absorption, also referred to as potential dose (mg ai/day);
Unit Exposure = Exposure value derived from August, 1998 PHED Surrogate Exposure Table; ORETF; or other study (mg ai/pound ai handled);
Use Rate = Application rate based on a unit treatment such as acres, a maximum value is generally used (lb ai/A); and
Daily Acres Treated = Application area based on a unit treatment such as acres/day (A/day).

Daily inhalation exposures were calculated using the following:

$$\text{Daily Inhalation Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) = \text{Unit Exposure}\left(\frac{\text{ug ai}}{\text{lb ai}}\right)*\frac{1\text{ mg}}{1000\text{ ug}}*\text{Rate}\left(\frac{\text{lb ai}}{\text{acre}}\right)*\text{Daily Treated}\left(\frac{\text{Acres}}{\text{day}}\right)$$

Where:

Daily Inhalation Exposure = amount that is available for absorption, also referred to as potential dose (mg ai/day);
Unit Exposure = Exposure value derived from February, 1998 PHED Surrogate Exposure Table; ORETF; or other study (mg ai/pound ai handled);
Use Rate = Application rate based on a unit treatment such as acres; a maximum value is generally used (lb ai/A); and
Daily Acres Treated = Application area based on a unit treatment such as acres/day (A/day).

Daily dermal and inhalation doses were then calculated by normalizing the daily dermal and inhalation exposure values by body weight. For occupational handlers using thiophanate-methyl, a body weight of 70 kg (median adult body weight) was used for short and intermediate-term dermal exposure scenarios because the thiophanate-methyl toxicity endpoints are based on adult animals' decreased body weight seen in the 21-day dermal toxicity study. A 70 kg body weight was also used for short and intermediate-term inhalation exposure estimates as the toxic endpoint selected for thiophanate-methyl was decreased body weight in the mothers seen in an oral developmental study in rabbits. Handler exposure is assumed to be to thiophanate-methyl only, based on available data (exposure to MBC is not anticipated). The non-cancer short- and intermediate-term dermal toxicological endpoint is 100 mg/kg/day. No dermal absorption factor

is needed for short- or intermediate-term exposures, since the endpoint is based on a dermal study. For long-term dermal and inhalation exposures, an oral endpoint was selected, therefore an absorption factor is applied:

$$\text{Daily Dermal Dose} = \frac{\text{Daily Dermal Exposure (mg ai/day)}}{\text{Body weight (kg)}} * \text{dermal absorption factor (0.07)}$$

Since the inhalation toxicity endpoint is based on an oral toxicity study, an adjustment is made for absorption. It is assumed that there is 100% absorption by inhalation, relative to the oral route. The dose for short- and intermediate-term inhalation was calculated using the following formula:

$$\text{Daily Inhalation Dose (mg ai/kg/day)} = \frac{\text{Daily Inhalation Exposure (mg ai/day)}}{\text{Body weight (kg)}}$$

Non-cancer risk estimates for short-, intermediate-, or long-term exposures are expressed as MOEs. Once the route-specific daily doses are calculated, the Margin of Exposures (MOEs) are calculated as follows:

$$\text{MOE (unitless)} = \frac{\text{NOAEL (mg/kg/day)}}{\text{Absorbed Daily Dose (mg/kg/day)}}$$

Although the NOAEL doses are different, there are common toxic effects of concern (i.e., decreased body weight and food consumption) for both dermal and inhalation endpoints. Therefore, the route-specific dosages may be aggregated to calculate a total MOE for the occupational scenario using the following formula:

$$\text{Total MOE} = \frac{1}{1/\text{MOE}_{\text{dermal}} + 1/\text{MOE}_{\text{inhalation}}}$$

2.1.2 Data and Assumptions for Handler Exposure Scenarios

Assumptions

The following assumptions and factors were used in order to complete the non-cancer exposure assessment:

- The median adult body weight of 70 kg was used for short and intermediate-term dermal and inhalation exposure scenarios because the toxicity endpoint is based on effects seen in both female and male adult animals. Although pesticide handlers are predominantly male at this time, there are also females and recent immigrants in pesticide work. Use of this body weight is believed to be protective of the general adult population.

- Average work interval represents an 8 hour workday (e.g., the acres treated or

volume of spray solution prepared in a typical day).

- Daily acres (or gallons or other unit as appropriate) to be treated in each scenario (Appendix Table 22) are based on HED estimates as cited in Exposure SAC policy guidance number 9, August 7, 2000.

- Mixer/loaders for lawn care operator (LCO) applicators for lawn treatments with hose-end spray guns were estimated to support 20 trucks, with each LCO spraying an estimated 5 acres per day, based on proprietary ORETF and industry information.

- Calculations are completed at the label-specified maximum rate for non-cancer toxicity, as most of the handler exposures will be of short- to intermediate term duration (one day to several weeks). The registrant-supplied "typical" application rates for specific crops, where available, were used to assess risk levels associated with the various use patterns.

- Due to a lack of scenario-specific data HED often calculates unit exposure values using generic protection factors (PF) that are applied to represent various risk mitigation options (i.e., the use of Personal Protection Equipment (PPE) and engineering controls). PPE protection factors include those representing a double layer of clothing (50 percent PF), chemical resistant gloves (90 percent PF) and respiratory protection (80 percent PF) for use of a dust/mist respirator. Engineering controls are generally assigned a PF of 98 percent.

Exposure Controls

There are three basic risk mitigation approaches considered appropriate for controlling occupational exposures. These include administrative controls (such as decreasing the application rate), the use of personal protective equipment or PPE, and the use of engineering controls. Occupational handler exposure assessments are completed by EPA using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) to achieve an appropriate margin of exposure or cancer risk. Baseline attire for occupational exposure scenarios is: long pants, long-sleeved shirt, shoes, and socks with no chemical resistant gloves or respirator. The next level of protection generally applied is PPE. As reflected in the calculations included herein, PPE involves the use of chemical-resistant gloves and/or a dust/mist respirator, depending on the route of greatest exposure. A second layer of clothing, such as coveralls, may be added for additional dermal protection. The next level of mitigation considered in the risk assessment process is the use of appropriate engineering controls which, by design, attempt to eliminate the possibility of human exposure. Examples of commonly used engineering controls include enclosed tractor cabs or cockpits, closed mixing/loading/transfer systems, and water-soluble packets. It is frequently more desirable to institute engineering controls because they are less stressful, more reliable, and afford a higher degree of worker protection.

Handler Exposure Data Sources

Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the reregistration of thiophanate-methyl. It is the policy of the HED to use surrogate chemical data from the Pesticide Handlers Exposure Database (PHED) Version 1.1 to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.[6] Neither chemical-specific nor PHED data were available for 3 handler scenarios. For two of these, treating seed and seed pieces, exposure data from the published literature were used to provide a rough estimate of exposures and risks from these use-patterns. For the third scenario, treating seedlings by dipping, no exposure data are available to EPA and this scenario was not assessed. Data are required to assess this scenario.

Pesticide Handler Exposure Database (PHED)

PHED was designed by a task force of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts -- a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates). Both dermal and inhalation route exposure data are contained in the PHED.

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based on the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in Table 22 in the Appendix. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. An example is the use of agricultural groundboom applicator exposure data as a surrogate for ground applications on golf course turf, where the equipment and other conditions are different.

Because of the insufficient number of data points for fixed-wing, open-cockpit aircraft in the PHED, these data should not be used. Exposure from open-cockpit planes is considered qualitatively to present a potentially greater exposure to applicators than closed-cockpit, but the quantitative extent remains a data gap until empirical data are generated. If the estimated MOE for application of a given pesticide using closed-cockpit data from PHED or a pesticide-specific exposure study is an order of magnitude larger than the uncertainty factor (i.e., the acceptable MOE), then the use of an open-cockpit fixed-wing aircraft for application also should be acceptable. The National Agricultural Aviation Association has informed the Agency that most applicators use closed cockpit planes.

HED has developed a series of tables of standard unit exposure values for many occupational scenarios that are utilized to ensure consistency in exposure assessments (PHED Surrogate Exposure Guide, V1.1. August, 1998). In addition, PHED is being revised and updated to include new and improved study data, such as the ORETF studies described below.

Outdoor Residential Exposure Task Force (ORETF) Study

The Outdoor Residential Exposure Task Force also submitted proprietary exposure studies to the Agency for either occupational or non-occupational residential applicator exposure under MRID 449722-01. Those studies include application of granular formulations by push-spreader (study number OMA001), professional lawn care operators (LCOs) using truck-mounted hoses with hand-gun controlled spray (OMA002), resident-applicator using a granular push spreader (OMA003), and resident-applicator using a hose-end spray (OMA004).

Surrogate chemicals were chosen by the Task Force for their representativeness based on physical chemical properties and other factors. These studies have been reviewed by Health Canada and use of the data are in review by the Agency. The ORETF exposure studies had greater numbers of replicates and therefore greater statistical power than studies previously used in PHED. Therefore, in the absence of chemical-specific data, the ORETF data will be used for mixer/loader/applicators using hose-end handgun spray, granular push spreaders, and hose-end sprayers. The ORETF data (geometric mean) values were used to calculate MOEs for the applicable occupational and non-occupational handler scenarios.

Seed Potato Treatment Study:

Treatment of seed potatoes is a major use of thiophanate-methyl. To address occupational exposures while operating commercial or smaller on-farm bulk seed treatment equipment, the HED has considered the 1980 seed potato treatment exposure study conducted by E.R. Stevens and J.E. Davis.[9] In that study, the investigators monitored handlers pouring Captan into seed hoppers of potato seed piece dusting machines, handlers cutting and sorting the treated potato seed pieces, operators of potato seed piece planters, and observers involved in the planting operations. The study was conducted on potato farms located in eastern Washington State during the potato planting season. Typically, potato seed pieces are treated at planting time. In the study, dermal exposure monitoring was limited to the hands, face, and neck, based on the assumption that handlers normally wear long-sleeved shirts or jackets and long pants, during

cool weather in the early spring when these operations are conducted. Hand exposure was not monitored for the handlers cutting and sorting the potato seed pieces, because they wore rubber gloves. However, hand exposure was monitored for the handlers filling the seed hoppers with Captan because these handlers wore canvas-backed leather gloves. Inhalation exposure monitoring was also conducted because it was observed that workers did not routinely wear dust respirators during these operations. The Gustafson thiophanate-methyl product labels, TOPS 2.5D and TOPS 2.5MZ require respirator use except for mixing/loading outdoors.

The USDA data for potatoes were examined and average farm size were found to vary between states, with 100 acres typical in Maine and 300 acres the average in Washington per 1992 reports. Planters use about 900-4600 lbs of seed potato pieces per acre, and 2500 lb/acre was chosen for consistency with prior HED estimates.[11] All commercial potato farms use mechanical planters and harvesters, so that this exposure route was considered negligible. Various experts estimated that each farmer could plant 30 acres per day, so that exposure, as a result of these operations, occurs 4 days per year on smaller farms, and up to 10 days per year for larger farms. A farm truck holds about 300 bushels, or 15,000 lbs of potatoes, and the Captan study stated it took between 45 minutes and 2 hours to treat a truck load. The potential hourly exposure rates are presented in Appendix Tables 5 and 6-8.

Seed Treatment: Planter Box Study

There are neither surrogate activity-specific nor chemical-specific data to address the use of thiophanate-methyl as an on-farm planter-box seed treatment. To address this scenario, the data from a published study of dust seed treatment using a surrogate chemical were used. Based on the BEAD QUA report, less than one percent of all peanuts are treated with this fungicide, but peanuts are a convenient example for use in an on-farm planter-box seed treatment.[6] The activity consists of adding small amounts of thiophanate-methyl dust to seed after it has been loaded into the planter seed hoppers. Thiophanate-methyl is either mixed into the top few inches of seed to help disperse the thiophanate-methyl dust or left alone to be mixed by normal shaking of the hopper as it moves through the field. Individuals are estimated to use thiophanate-methyl 5 days per year as planter box treatment (based on an average farm size of 100 acres planted at 20 acres per day).

R. Fenske, et al.,[10] monitored 12 workers (in a total of 60 exposure periods) treating seed by hand using a dust formulation of Lindane insecticide. The workers wore long-sleeved clothing and gloves. The combined dermal and inhalation exposure estimated by Fenske, et al., adjusted to lb ai handled, was 10.4 mg/lb ai. Workers in this study were wearing chemical-resistant gloves and long-sleeved garments, but 81% of the measured dose was from the body and 13% from the head and neck, so coveralls and head/neck protection would help decrease the total dermal dose. Label directions, USDA and BEAD use information and agronomist expertise on farm practices have been used to represent a typical use scenario. The Fenske study indicated that each worker could load seed into a 12 bushel grain drill (planting machinery) and mix in a dust seed treatment, each treatment requiring about 5 minutes. EPA has determined that peanuts may be planted at 100 lb (shelled) seed/acre, and the HED estimates as many as 20 acres may be

planted in a day, or 2000 lbs of seed treated per day. Therefore the worker would handle, at a high-end treatment rate of 0.047 lb ai/100 lb seed, 0.94 lb ai per day, for an exposure of 0.94 lb ai/day x 10.4 mg/lb ai = 9.8 mg/day (an absorbed dose of 0.01 mg/kg/day). This value is closely correlated with the hourly rate of exposure estimated by Fenske, et al. in the Lindane study.

Seedling Dip Treatment

There are no available data for exposures during seedling treatment, which is also a labeled (ornamental) use of thiophanate-methyl. Therefore the exposure risks for this use have not been evaluated, and new studies or data are needed.

2.1.3 Occupational Handler Exposure and Non-Cancer Risk Estimates

The risk assessment that has been completed for the occupational handler scenarios is presented in Tables 6-8. The risk assessment is summarized herein and in Table 5. Please refer to the appropriate tables as stated in text, as they are the basis for this risk assessment. HED defines chronic exposures as use of the chemical for approximately 180 days per year (or more) and it is anticipated that thiophanate-methyl, as with other typical pesticide compounds, will not be used in this manner.

Short- and intermediate-term non-cancer risks were estimated for each of the handler scenarios identified for thiophanate-methyl where exposure data were available. Since the toxicological effects from dermal exposures are similar to those from inhalation exposures, the non-cancer risk estimates (MOEs) from dermal and inhalation exposures are aggregated in this assessment. Non-cancer risks are assessed using the maximum application rate for each crop or use-pattern and standard values for the number of acres treated (or gallons handled) per day. For thiophanate-methyl, the level of concern established by the HED for occupational non-cancer risks is a margin of exposure of 100. The risks initially are assessed assuming handlers are using baseline attire (i.e., long-sleeve shirt, long pants, shoes, and socks). If risks exceed the level of concern for a given scenario with baseline attire, then risks are assessed with the addition of personal protective equipment (i.e., chemical-resistant gloves, double-layer body protection, and/or a respirator) as required. In general, the HED uses the least PPE necessary to achieve risks that do not exceed the level of concern, i.e., attain the target MOE. Therefore, several levels of increasing personal protection and engineering control were calculated and are presented in Tables 6-8. Also, if the risks due to *inhalation* exposures exceed the level of concern by at least two-fold (i.e., MOE $ 200) at baseline (no respirator), then the inhalation MOE will not contribute significantly to an aggregate (dermal + inhalation) MOE; therefore addition of a respirator is not warranted for that scenario. If the risks exceed the level of concern for a given scenario even with the addition of PPE, then the risks are assessed with the use of engineering controls (i.e., closed system mixing/loading and enclosed cabs or cockpits for applying and flagging).

Tables 5-8 include all of the information required to calculate MOEs such as the acres treated per day (A/day), application rate (lb ai/A) and the dermal and inhalation unit exposures for each

occupational handler exposure scenario at each level of risk mitigation. Separate MOEs were calculated for dermal and inhalation exposure routes by comparing the NOAEL assigned by HIARC to the relevant daily dose level. Because both short- and intermediate-term dermal and inhalation have the same toxicological endpoints, the MOEs may be combined as stated in section 1.3. Each route-specific MOE value is presented to represent both short- and intermediate-term dermal and inhalation exposure scenarios. The combined risk of both exposure routes is also presented. If MOEs for any scenario exceeded 100 the risk assessment is considered protective and further mitigation is not required

The short- and intermediate-term non-cancer risks to occupational handlers at baseline attire, with the addition of PPE, and with the addition of engineering controls are shown in Tables 6a-8a. Overall, about half of the baseline exposure scenarios had MOEs of 100; 90% when maximum PPE were added, and all MOEs were greater than 100 when engineering controls were added, if feasible. In general, where data for baseline exposures were available, risks did not exceed the level of concern (*except* when application rates exceed 10 pounds per acre) at baseline attire for:

- mixing and loading dry flowable formulations,
- loading granular formulations,
- applying,
- mixing/loading/applying, and
- flagging.

For mixing and loading wettable powder formulations to support aerial or chemigation applications, engineering controls (i.e., water-soluble packaging) are required for many crops and use-patterns. For the remaining handler scenarios, in general risks did not exceed the level of concern with the addition of PPE, *except* in a few instances when application rates exceed 10 pounds per acre. While the addition of gloves to baseline protection increased MOEs to > 100 for most (83%) of scenarios, adding respirators and coveralls only increased the number of scenarios with MOEs >100 to 90%. The MOEs were less than 100 for the highest application rate for loader/applicators using push-spreaders and belly grinders, and no feasible engineering controls are available.

2.1.4 Handler Exposure and Risk Estimates for Cancer

The lifetime average daily dose (LADD) for use in the cancer assessment was calculated using the following formula:

LADD (mg/kg/day) =
Daily Total Dose (mg/kg/day) * (days worked/365 days per year) * (35 years worked/70 year lifetime)

where: Daily Total Dose (mg/kg/day) =
[Daily Dermal Dose (mg/kg/day) * Absorption factor] + Daily Inhalation Dose (mg/kg/day)

The number of years worked (35), body weight (70 kg) and lifetime (70 years) are population standard values based on the EPA's Exposure Factors Handbook. The number of years worked varies greatly for each occupation, and 35 years in any single job is a high-end estimate. The number of days worked per year for each handler scenario (Tables 6b-8b) are based on consultation with agricultural experts and believed to be reasonable estimates for average or typical use of this chemical.

Cancer risk is calculated using the following formula:

$$\text{Risk} = \text{LADD (mg/kg/day)} * Q_1^* \text{ (mg/kg/day)}^{-1}$$

Dermal absorption adjustment is necessary for the cancer assessment because the cancer endpoint is based on oral/feeding studies. A dermal absorption factor of 7 percent, and an inhalation absorption factor of 100 percent are used in the calculations.

Cancer risks were estimated for the various handler scenarios using two categories of handlers: private and commercial. "Private" handlers are assumed to mix, load, apply, or otherwise handle thiophanate-methyl as part of their duties on a single agricultural establishment of a typical size. "Commercial" handlers are assumed to be either custom "for-hire" applicators or individuals who handle thiophanate-methyl on a very large agricultural establishment. The HED assumes that private handlers would handle thiophanate less frequently than commercial handlers. Except where specific information is available, commercial handlers are assumed to handle thiophanate-methyl ten days for each one day that private handlers are assumed to handle it. When available, EPA used the average or "typical" application rate for assessing cancer risks, since the assessment is based on a lifetime of exposure. In general, EPA considers occupational cancer risk estimates greater than one in ten thousand (10^{-4}) to be of concern, and attempts to mitigate occupational exposures so that cancer risk estimates are one in one million (1×10^{-6}) or less, where feasible.

Tables 5b-7b summarize the estimated cancer risks to private and commercial occupational handlers for each of the handler scenarios with baseline attire, with the addition of PPE, and with the addition of engineering controls. At baseline, most of the exposure scenarios had estimated cancer risks less than 10^{-4}, but greater than 10^{-6}. Cancer risk estimates at baseline for private and commercial handlers range from 9.4×10^{-4} to 3.1×10^{-9}, and from 9.4×10^{-3} to 9.2×10^{-9},

respectively. With the addition of PPE, cancer risk estimates for all private handler scenarios and most commercial handler scenarios were less than 10^{-4}. When PPE is added to scenarios with baseline cancer risk estimates greater than 10^{-6}, risk estimates for private and commercial handlers ranged from 5.5×10^{-5} to 1.2×10^{-8}, and from 5.5×10^{-4} to 2.2×10^{-7}, respectively. With the addition of engineering controls, where risk estimates greater than 10^{-6} and where feasible controls exist, cancer risk estimates for all private handler scenarios were equal or less than 10^{-6}, and estimates for commercial applicators ranged from 2.9×10^{-5} to 1.1×10^{-7}. Handler scenarios with high application rates (greater than 10 lbs ai/acre), very high acreage crops (i.e., 1200 acres per day) or hand-held application equipment generally had cancer risk estimates greater than 10^{-6}, even with addition of PPE or engineering controls. Most hand application methods (hand-directed sprays, spreaders, etc.) do not have a practical means of enclosure or other engineering control.

Note that in some cases where the cancer risk estimate is less than 10^{-4} but greater than 10^{-6}, additional PPE may afford little additional risk reduction. In all cases, administrative and engineering controls are preferable to personal protective equipment, owing to the inherent health and safety risks from using the equipment and variability in protective value. Tables 6, 7 and 8 provide detailed information about the exposure and risk estimates to handlers at baseline, with additional PPE, and with engineering controls.

2.1.5 Summary of Risk Concerns for Handlers, Data Gaps, and Confidence in Estimates

No surrogate or other data were available for estimating exposures from mixing/loading/applying water-dispersible granules (WDG) with a low-pressure handwand. However, surrogate data were available in PHED for this scenario when using wettable powder and liquid formulations, and exposures to WDG are believed to lie between the estimates for those two scenarios. Data were not available for application of slurry seed treatment or the treatment of seedlings or bulbs with dip applications. Data gaps prevent the Agency from characterizing occupational exposure to thiophanate-methyl for these scenarios. Data needs are as follows:

OPPTS Guideline No.	Study	Crop
Handlers:		
Dermal Exposure:		
875.1100	Outdoor Mixing/loading/applying WP/DF solution	Seedling or bulb treatment
875.1200	Indoor Mixing/Loading/Applying WP	Greenhouse use
Inhalation Exposure:		
875.1300	Outdoor Mixing/loading/applying WP/DF solution	Seedling or bulb treatment
875.1400	Indoor Mixing/Loading/Applying WP	Greenhouse use

By using surrogate study data from PHED, it is assumed that pesticides of similar formulation result in similar exposures when handled in the same manner. Several handler assessments were completed using "low quality" PHED data because of the lack of a more acceptable data set (see Exposure Scenario Table 22 for further details). PHED is widely recognized and used by federal and state governments and private authorities in the field to assess pesticide handler exposure

and risks. Similar limitations and limits of confidence may be associated with the use of data from other chemical studies, such as the Captan study of seed-potato treatment and the Fenske, et al., study of seed treatment. Exposure during certain application scenarios, such as greenhouse low or high-pressure hand spraying, are also highly variable due to local conditions, and facility size and layout.

Estimates of the daily acreage treated are based on the best data available, which in some cases is limited. Data from various sources, including the USDA and state data. For example, while the Turfgrass Producers International states the median size of sod farms is 350 acres, it is not known to what extent aerial applications are used, or the specific type of ground application equipment used, which may affect the standard acreage applied in the exposure estimates. Similarly, aerial applicators provided information supporting 60-80 acres per day for treatment of ornamentals with thiophanate-methyl, but there are no data on the frequency of treatment, or percent of crop treated. The daily acreage of ornamentals treated and equipment types used are also considered data gaps; therefore standard values were used.

2.1.6 Recommendations

Where risk estimates exceed the level of concern, administrative or engineering controls should be instituted preferentially over use of additional protective equipment. Data should be submitted for those labeled uses where there are no handler data available, principally slurry seed treatment and seedling treatment, although chemical-specific handler data on all seed treatment uses would help refine risk estimates (see section 2.1.5).

2.2 POST-APPLICATION EXPOSURE AND RISK ESTIMATES

2.2.1 Post-Application Exposure Scenarios

The HED is concerned about potential occupational postapplication exposure to thiophanate-methyl, and it's metabolite MBC, from entering treated fields, orchards, nurseries, greenhouses, sod farms, or golf courses. Given the nature of activities in these locations, and that thiophanate-methyl is applied at various times during plant growth, contact with treated surfaces is likely. Some potential exposure scenarios of concern include:

- scouting (early and late season);
- irrigating;
- harvesting, pruning, transplanting,
- thinning; and
- handling treated seed and seed pieces.

Table 10 includes the representative crop types and activity types for each crop used in this risk assessment.

2.2.2 Data and Assumptions for Exposure Scenarios

Elf-Atochem submitted 3 dislodgeable foliar residue (DFR) studies that address the dissipation of thiophanate-methyl on apples, strawberries, and ornamentals grown to produce cut flowers, and a study of turf transferable residues (TTR) on grass. The studies are reviewed below. The studies reported residues of both the parent compound, thiophanate-methyl, and the active metabolite, carbendazim (MBC). All of the post-application residue studies found that the levels of MBC were initially low in comparison to the parent compound, thiophanate-methyl, and gradually increased. A different toxicological endpoint was determined for MBC. Therefore, the thiophanate methyl and MBC residues were considered separately in the risk assessment. Separate risk estimates were performed for both the parent and the metabolite with thiophanate-methyl constituting the majority of exposure in all cases.

Postapplication Risk Assessment Assumption and Factors

The following assumptions and exposure factors served as the basis for completing the occupational risk assessment:

- The average body weight of an adult used in all occupational handler short- and intermediate-term non-cancer risk assessments for thiophanate-methyl is 70 kg. A body weight of 60 kg is used for determining the MOEs for MBC exposure because the NOAEL is based on the toxic effects seen in a developing fetus and 60 kg is the mean weight for adult females.

- Long-term non-cancer effects were calculated using the chronic dietary endpoint and a body weight of 70 kg for adults.

- It should be noted that lower body weights and greater proportionate surface in teen-age workers is offset somewhat by a lower transfer coefficient, that is, they generally have less contact with treated foliage in the same time period as adults. Therefore, the adult body weight and transfer coefficient produce an exposure estimate that is believed to be protective of workers 13 years of age and older.

- Most post-application worker exposures to thiophanate-methyl and MBC are assumed to be of short- to intermediate-term duration, based on the available use data. Owing to the slow dissipation rate of thiophanate-methyl seen in submitted studies, however, it is possible that some workers may be exposed over a period greater than 180 days per year. This is most likely to happen in an enclosed greenhouse situation, where residues decline slowest, or in picking strawberries. The average application rate based on BEAD estimates is once per season per crop, but labels allow repeated application when needed. Also, greenhouses may produce several "crops" per year and rotate or sell plants as they grow.

- For post-application exposures, both the parent compound and the metabolite (MBC) may be of concern. Where MBC dermal exposure was measured or is expected, the MBC short- and intermediate-term endpoint of 10 mg/kg/day will be applied (with a dermal absorption factor of 3.5%) to determine a separate reentry day MOE. Based on the residue dissipation data, long-term exposures to MBC are not anticipated.

- Inhalation exposures were not calculated for the postapplication scenarios (i.e., Total Daily Dose in the MOE calculation only represents dose levels resulting from dermal exposures because the data reflect inhalation exposures which have been shown historically to account for a negligible percentage of the overall body burden; and the vapor pressure of thiophanate methyl is low at 1.3×10^{-5} mm of mercury and MBC is even lower at 7.5×10^{-10} mm of mercury).

- Single day exposures were calculated to reflect chemical specific residue dissipation rates over time coupled with the standard transfer coefficients shown in Tables 10-15.

- The exposure duration for the worker population is 8 hours.

- There were no chemical-specific data submitted to determine foliar transfer coefficients (Tc) for thiophanate-methyl or its MBC degradate. The HED found thiophanate-methyl-specific data in a 1992 cut-flower worker study by Brouwer, et al., which is described in the study data section which follows. For all other postapplication activities, this assessment relied upon the EPA Science Advisory Council for Exposure policy on agricultural transfer coefficients (Policy 3.1, 08/07/00). This internal guidance incorporates all available reviewed data, including that proprietary data submitted thus far by the Agricultural Reentry Task Force (ARTF), published data, and all Agency submissions. The use of more activity-specific data has increased the complexity of this assessment.

- The submitted postapplication residue studies provide DFR data for apples, strawberries, greenhouse crops, and turfgrass. The DFR data in these studies were collected at two sites for each of these crops. Because of the absence of additional DFR data for many individual crops, the apple DFR data were used to represent tree fruit and nut crops, grapes, and woody ornamentals and the strawberry DFR data were used to represent all other outdoor crops, except turfgrass. Because the apple study residue declined at greatly different rates in the two locations, each is used separately to account for geographic or climatic variation. Non-woody crop residues were based on the California strawberry DFR data as it presented a slightly slower dissipation rate and higher initial residue that therefore provides a more conservative assessment. The residue data from treatment of roses and chrysanthemums in the greenhouse studies are used to represent a range of plant residues grown indoors. Although the use of crop specific residues to estimate residues of thiophanate-methyl and MBC on other types of crops introduces uncertainties in the postapplication analysis, it is believed to be more realistic than assuming a standard initial residue value based on the application rate and an assumed dissipation rate per day. It is reasonable to believe that the residues monitored in the available studies approximate the residues on another crop or another area within a region. The extent that these residues might be an under- or over -estimate is unknown.

The chemical-specific DFR and TTR dissipation data from the four studies submitted were used to complete the postapplication risk assessment. Transferable residue levels (i.e., DFRs) were calculated based on study data using the equation D2-16 from the OPPTS Series 875 Test Guidelines, given below. The factors for this equation were developed based on a semilog regression of actual measured dissipation data for thiophanate-methyl applied to each crop in each test site:

$$C_{envir(t)} \text{ ' } C_{envir(0)} e^{PAI_{(t)}(M}$$

Where:

$C_{envir(t)}$ = transferable residue concentration (µg/cm^2) that represents the amount of residue on the surface of a contacted leaf surface that is available for dermal exposure at time (t);

$C_{envir(o)}$ = transferable residue concentration (µg/cm^2) that represents the amount of residue on the surface of a contacted leaf surface that is available for dermal exposure at time (0);

e = natural logarithms base function;

PAI_t = postapplication interval or dissipation time (e.g., DAT day); and

M = slope of line generated during linear regression of data [ln(C_{envir}) versus postapplication interval (PAI)].

Once the slope (M) and y-intercept (b) of the regression line has been determined, the linear equation can be used to predict DFRs at specific times post-application. This equation is:

$$\ln C_{envir(t)}) = (M * PAI_{(t)}) + b$$

The predicted DFRs are essential to calculating the dose and therefore the MOE. The calculations used to estimate Daily Dermal Dose and MOE for the dermal postapplication scenarios are similar to those described above for the handler scenarios. The transfer coefficients (Tc, cm^2/hour) represent an approximation of the total leaf surface area a worker would contact over an hour when performing a task. Therefore, assignment of a Tc is dependent on the task performed, the height and the foliage of crop. Transfer coefficients are used to translate the DFR values to activity patterns (e.g., scouting, harvesting) to estimate potential human exposure. The values assigned by the Science Advisory Committee on Exposure for dermal transfer coefficients represent reliable estimates of potential exposure during the specified tasks. No standard transfer coefficient value has been set for handling treated crops in the field during sorting and packing activities, but preliminary data suggest a low to moderate transfer rate, i.e. between 1000 and 2500 cm^2 per hour. Therefore sorting and packing exposure are not specifically addressed in this assessment. Table 10 includes a summary of potential activity-specific contact rates for crops used in the postapplication assessment.

Dermal Dose values on each postapplication exposure day were calculated using the following equation:

$$\text{Dermal Dose}\left(\frac{\text{mg ai}}{\text{kg / day}}\right) = \frac{\text{TR}[_t]\ (\frac{\text{ug}}{\text{cm2}}) * \text{Tc}\ (\frac{\text{cm2}}{\text{hr}}) * \text{DA}\left(\frac{\%}{100}\right) * \left(\frac{\text{Hr}}{\text{Day}}\right) * 1\text{ mg}}{\text{BW(kg)} * 1000\text{ ug}}$$

Where:

TR = transferable residue (i.e., dislodgeable foliar residue, DFR) at time (t) as defined above (Fg/cm^2);
Tc = transfer coefficient or measure of the relationship of exposure to transferable residue concentrations while engaged in a specific mechanical activity or job function (cm^2/hour);
DA = dermal absorption (%);
Hr = exposure duration or hours engaged in specific mechanical activity (hrs);
BW = body weight (kg); and
Dermal Dose $_{(t)}$ = absorbed dose attributable to exposure at time (t) when engaged in a specific mechanical activity or job function (mg/kg/day).

The use of personal protective equipment or other types of equipment to reduce exposures for post-application workers is not considered practical or enforceable. The Restricted Entry Interval or REI is a measure of the time it takes for residue levels to decline to a point that entry into a previously treated area and engaging in a task or activity would not result in exposures that exceed the HED's level of concern during reregistration. REIs are generally established in the risk assessment process on a chemical-, crop-, and activity-specific basis. This assessment will provide MOEs for crop-specific reentry times to assist risk managers in determining an REI.

Study Data

Along with the chemical-specific data, guidance provided in OPPTS Series 875[10] were used to complete various aspects of this risk assessment.

Table 9 summarizes the study data used in the development of the post-application risk assessment. In order to better understand the data presented in Table 9, a brief summary of these studies follows.

MRID 448763-01: [12] Dissipation of dislodgeable foliar residues of Topsin M (70 percent thiophanate-methyl) on apple leaves were quantified. Topsin® M WSB, 70 percent ai wettable powder in water soluble bags was applied twice (seven days apart) to apple trees growing in New York (NY) and Washington State (WA). Target application rates were 1.05 lb ai/acre, actual rates were 1.05-1.06 lb ai/acre. Each application was made with a tractor mounted airblast sprayer, after fruit set, as directed. The DFR samples were collected in a manner which deviated slightly from the recommended practice in the pattern of collection. Rainfall in New York was about twice the normal average, while in Washington state rainfall only occurred once after each application and under-tree drip irrigation was used. The key findings of the study were: (1) thiophanate-methyl dissipated more quickly in NY than in WA; (2) thiophanate methyl appeared to accumulate after sequential applications. Weather may have been a factor in dissipation times.

Significant deviations from the Guidelines for postapplication studies, or errors included:

- DFR samples were collected from only two geographical locations, instead of three as recommended by the EPA OPPTS 875.2100 Guideline, but the 2 sites selected are fairly representative of the east- and west-coast apple growing climates;
- Thiophanate methyl was applied in a spray volume ten times higher than the minimum label dilution rate of 10 gallons/A;
- There is no evidence that the analytical method employed had been validated prior to the initiation of the study;
- Field storage and transport temperatures were not measured in the New York trial;
- The storage interval range for the fortification samples does not cover the range necessary to accommodate the field data;
- The upper and lower range of detected thiophanate-methyl in field samples exceeded the high level fortification level of 500 Fg (maximum: 827 Fg in NY) and the lower fortification level of 200 Fg (actual minimum: 12 Fg in NY);
- It is not clear in the report if field samples were dislodged within 4 hours after collection

In spite of these deficiencies, it was decided that these data were of sufficient quality to support the postapplication risk assessment. The study data indicated no problem with storage stability. The field fortifications were mostly within the guideline range of 70-120 percent (range 68-113%).

The maximum DFR of thiophanate-methyl measured in NY was 2.1 $\mu g/cm^2$ and in WA, 2.7 $\mu g/cm^2$ on the day of treatment and 3 days after treatment (DAT 0 and DAT 3), respectively. It should be noted that thiophanate-methyl DFR data from the WA test site did not decline below the level of quantitation (LOQ) of 0.05 $\mu g/cm^2$ up to DAT 84. The authors also analyzed DFR samples for the metabolite MBC, the maximum residue of which (0.395 $\mu g/cm^2$) was measured

on DAT 14 after the second application in WA. Prior to that point, MBC levels are only about twice the LOQ. After that point, a slow decline back to twice LOQ occurred by DAT 84 (the last samples collected). At the NY site, a similar pattern obtained, except that MBC levels declined to twice LOQ by DAT 28.

The HED analyzed the authors' data-sets, correcting the thiophanate-methyl and MBC DFR data for field fortification recoveries. Using DAT 0 to DAT 21 in New York and DAT 0 to DAT 84 in Washington, all data replicates greater than the LOQ were analyzed by completing a semi-log regression and a pseudo-first order kinetics calculation of half-life as described in the EPA OPPTS 875 Guidelines (the authors analyzed daily average residues). Predicted dissipation half-lives were 3.8 days ($R^2 = 0.94$) for the New York site and 31 days ($R^2 = 0.88$) for the Washington site. The lower correlation value for Washington state may be attributed to the initial rise in DFR mentioned above. The latter value is almost two times higher than that calculated by the authors.

MRID 448662-01.[13] Dissipation of dislodgeable foliar residues of Topsin M (70 percent thiophanate-methyl) on strawberry leaves were quantified. Two foliar applications (actual rate 0.72 lb a.i. per acre) were applied to *Seascape* strawberry plants in California and *Chandler* strawberry plants in North Carolina using groundboom equipment. The two applications were scheduled to be made 7 days apart at both sites; however, the second application at the NC site took place 8 days after the first application because of inclement weather. The author proposed that the use of this product on strawberry plants in California represented a reasonable worst-case scenario for potential exposure to individuals as per the proprietary exposure activity database compiled by the ARTF. The California and North Carolina sites represent important climatic conditions and covers the significant climate variations. Drip or furrow irrigation was applied during the study when rainfall was insufficient at the two sites to maintain healthy, representative plants. These irrigation methods were typical for the respective areas and did not result in water contacting the foliar surfaces. Rain fell repeatedly at both test sites, including two days after the second application in North Carolina, and on the day of second application and the next day in California.

The thiophanate-methyl residue levels peaked immediately after both applications and then steadily declined to below the LOQ by Day 7 after the second application at the NC site. It rained the same day as the second application at the CA site and therefore, the residue recoveries were already below LOQ by Day 1 after the second application. The highest average DFR values were 1,212 Fg (3.03 $\mu g/cm^2$) corrected thiophanate-methyl for NC and 962 μg (2.4 $\mu g/cm^2$) thiophanate-methyl for CA. Residues of MBC were negligible, with the highest average DFR equal to 30 μg (0.075 $\mu g/cm^2$) at the CA site and 26 μg (0.065 $\mu g/cm^2$) at the NC site. Laboratory and field fortification recoveries averaged over 90% at both sites.

Overall, this study met most of the EPA OPPTS 875 test guidelines and will be used in the thiophanate-methyl risk assessment. Significant issues included:

- the maximum seasonal application rate of 2.8 lb ai/A was not applied;

- it could not be determined from the report if the collected field samples were dislodged within 4 hours after collection as specified in the field protocol;
- coefficients of variance for replicate samples at the NC site ranged from 5.4 percent to 44.6 percent for Thiophanate-methyl/MBC combined;
- OPPTS 875.2100 recommends that DFR data be collected from at least three geographically distinct locations for each formulation, but DFR samples were collected from only two locations. The locations selected are fairly representative of the dry western growing regions and relatively wet southeastern region.

In spite of the deviations from Guidelines, the study is of sufficient quality to be used in the thiophanate-methyl risk assessment. The data sets were analyzed by the HED using semi-log regression of the thiophanate-methyl and MBC residues for each site separately. For the NC site, the regression analysis was run using Day 0 to Day 7 data after the second application and a dissipation half-life value of 1.4 days ($R^2 = 0.81$) was determined. For the CA site, the regression analysis was run using Day 0 to Day 7 data (pre-application #2) (excluding Day 1 data because all were non-detectable) after the first application (because of the rain event which occurred the day of the second application). The half-life calculated was 1.5 days ($R^2 = 0.75$) for the California site data.

MRID 450007-01.[14] Dissipation of transferable turf residues (TTR) of 3336WP (50 percent thiophanate-methyl) were quantified using the Modified California Roller technique for collecting residues. A cotton sheet and a plastic sheet are attached to a sampling frame, and placed on the turf test area, cotton side down; then a weighted, foam-covered roller is rolled over the sheet five times, the sheet is collected and analyzed for residues. The study called for two turf applications of 8 oz product (0.25 lb a.i.) per 1000 ft^2 to be made on different varieties of grass in California (CA), Pennsylvania (PA), and Georgia (GA) using ground application equipment. Actual field application rates were apparently higher, up to 2.5 times the cited rate. Two applications were made 7 days apart at all sites.

The thiophanate-methyl residue levels peaked 8-12 hours after the second application at the GA and PA sites. The first application at all sites, and the second application at the California site showed a steady decline to below the LOQ by Day 7 in GA and CA but not PA. Rain and irrigation were heaviest at the CA and GA sites, while there was no recorded irrigation after the second application at PA. This may explain the slower dissipation of residues at the PA site. The author suggests that the second applications at GA and PA follow a bi-phasic pattern of dissipation (two distinct dissipation slopes), however such a model does not explain why residues are greater at 8-12 hours post-application than either immediately post-application or at 1 day after treatment. Field fortification recoveries averaged over 90% at CA, 79% at GA, and 87 % at PA sites. However, because less than 20% of the sample data were within the fortification levels used, higher fortification levels should have been chosen to reflect the range of sample data.

Most EPA Series 875 Study Guidelines were met by the studies. There was a wide range of variance in daily field data at each site, from as little as 3.4% to 72%, although most were less

than 40%. There are no strict guidelines for acceptability of field variance, but high levels decrease confidence in the data.

The GA and PA data were adjusted for field recoveries below the 90% guideline criterion. The data were then analyzed by HED, using semi-log regression of the thiophanate-methyl and MBC residues for each site separately. The predicted initial DFR for the GA site was 1.65 $\mu g/cm^2$ (R^2 = 0.78) with a half-life of 1.6 days. The predicted half-life for the CA site was 1.4 days, with an initial residue of 1.9 $\mu g/cm^2$ (R^2 = 0.84). The slowest dissipation and longest half-life (4.05 days, R^2 = 0.42, initial DFR = 1.75 $\mu g/cm^2$) were from the PA study data. The best fit to the data was obtained by correcting the GA data for field recoveries, combining it with the California data (which did not require correction), then averaging the site TTRs day-by-day. The predicted TTR values obtained are very similar to the average of the raw data from the second application at the 2 sites. The dissipation line (R^2 = 0.92) obtained from the average of the GA and CA data yields a half-life of 1.5 days and 37% dissipation per day. The analysis also shows an initial deposition of about 1.1% of the active ingredient applied, which agrees well with prior studies on other chemicals. The fact that the California and Georgia plots were watered after the second application, and the PA was not indicates that watering lowers the residue and decreases the dissipation time by approximately half. This finding agrees with the longer dissipation times seen on Washington (dry) apple leaves versus New York (wet) apple leaves. This data may support the use of climate or regional-specific REIs.

Residues of MBC were negligible, and were largely less than the LOQ at all three sites. The highest TTRs were 400 μg (0.07 $\mu g/cm^2$) at the PA site, 302 μg (0.054 $\mu g/cm^2$) at the GA site, and 249 μg (< LOQ) at the CA site. The findings showed low residue relative to thiophanate-methyl and slow dissipation, consistent with the slow MBC dissipation seen in the other submitted studies.

MRID 45027501.[15] The registrant (Elf Atochem) submitted a cut-flower DFR study in February, 2000. The study, which was conducted on roses and mums in greenhouses, appears to meet most of the OPPTS Series 871 Post-Application Exposure study guidelines. The study was conducted in only one geographic location in two greenhouses, but geography has little effect on the actual greenhouse environments. The flowers were sprayed using a high-pressure handgun at the highest labeled rate for flowers and ornamentals of 16 oz of 3336 WP (50% thiophanate-methyl in water-soluble bags) per 100 gallons of water. Two applications were made, seven days apart, at an actual rate of 1.05-1.18 lb ai/acre. Residues were collected and dislodged using in compliance with OPPTS Guidelines. Average field fortification recovery values (108 + 8.3%) exceeded the guideline standard, therefore the residue data did not require correction.

The measured DFRs of thiophanate-methyl increased from days 0-1, remained constant through day 5, and declined slowly after day 7 after spraying. The dissipation rate was calculated with the DFR data after the second application, using semi-log regression of the thiophanate-methyl and MBC residues for each site separately. The mean thiophanate-methyl DFR from the study (5 Fg/cm^2 at DAT 1) and half-life (19 days) from the log-transformed study data were used to estimate worker REIs. The MBC residues slowly rose to a maximum 2 and 3 weeks after

application for mums and roses, respectively. These data do not fit a first order dissipation pattern, and so semi-log linear regression equations yield predicted values with poor correlation ($R^2 < 0.5$) to the log-transformed data. The maximum mean DFR value for MBC was 0.35 Fg/cm^2 on DAT 14 for the mums.

D.H. Brouwer, et al. (1997)[16] This published study reported the half-life of thiophanate-methyl applied to carnations at two rates, 150 and 325 grams ai/1000 m^2 (equivalent to 1.3 to 2.9 lb ai/acre, which is within the label maximum of 3 lb ai/acre). The methodology used for collection of DFR samples and dislodging the active ingredient was consistent with EPA 875 series guidelines. Laboratory method validation samples had a coefficient of variation of less than 5%, although the sample size (n=6) was small. Results were analyzed by linear regression and results with probability levels p >0.05 were not included in half-life estimates, which may have affected the calculated half-lives in an undetermined way. Thiophanate-methyl half-life calculations were 22 days for the lower application rate and 41 days at the higher rate.

R. Brouwer, et al. (1992)[17] This carnation harvesting study reported worker exposure rates of 16.1 mg/hr for cutting (n = 21) and 11.5 mg/hr (n = 4) for sorting and bundling flowers treated with thiophanate-methyl. When proportionately adjusted for maximum EPA label rate for ornamentals, the exposure rates are 14.6 and 10.5 mg/hr, respectively. The flowers were treated approximately 35 hours before harvest, but Brouwer presents evidence that there is no significant decline in foliar residues before the harvest, up to 60 days after application. By that time the flowers are usually harvested and new leaves arise (which lack the pesticide). The initial DFR from the study was 4.47 Fg/cm2, which is 4.06 Fg/cm^2 when proportionately adjusted for the maximum EPA ornamental label rate. The transfer coefficient used by Brouwer was 4500 cm^2/hr, which is based on residue from both sides of the leaves, as is HED practice.

The data from the Brouwer studies can be combined to determine an estimate of greenhouse worker exposure. A range of handler exposure can be estimated using 10-15 mg/hr. Because Brouwer, et al. (1992), were consistent with HED practice in measuring two-sided DFR data, the HED has adapted the data for assessment of postapplication exposure from working with greenhouse flowers and ornamentals. The post-application exposure was estimated using a range of transfer coefficients based on the Brouwer study data, which account for typical greenhouse activities, and are specific to thiophanate-methyl. Brouwer, et al. (1997) also found a half-life between 22 and 41 days, and an initial residue of 4.1 Fg/cm^2. These data support the submitted cut-flower study data.

2.2.3 Postapplication Exposure and Non-Cancer Risk Estimates

Post-application risks were estimated for occupational workers using studies submitted by the pesticide registrant, Elf Atochem. Elf-Atochem submitted 3 dislodgeable foliar residue (DFR) studies that address the dissipation of thiophanate-methyl on apples, strawberries, and cut flowers respectively, and a study of turf transferable residues (TTR).[9,10,11,12] Since only the published Brouwer, et al. studies provided chemical-specific transfer coefficients for thiophanate-methyl, standardized values were used for all other activities, based on the EPA Science Advisory Council for Exposure policy on agricultural transfer coefficients (Policy 3.1, 08/07/00). For occupational exposures, an 8-hour exposure day was assumed. For assessing short- and intermediate-term risks, the maximum application rate for each crop is assumed, whereas for assessing cancer risks the typical application rate by crop, if known, is assumed. Risks from short- and intermediate-term exposures are assessed based on the DFR data on day 0 or day 1, which ever is greater. Cancer risks are assessed based on the average DFR data in the range of day 1 to day 14, since in general, thiophanate-methyl labels permit reapplication at 14-day intervals. This means that if the restricted-entry interval were set at day 1, EPA estimates that workers would enter treated areas on days 1 through day 14, with the average exposure being the average DFR residues between days 1 and 14. If cancer risks exceed the level of concern based on the average DFR between day 1 and 14, then risks are assessed using the average day 2 to day 14, day 3 to day 14, etc. This assesses the risks with increasing reentry intervals until the cancer risk estimate is less than 10^{-6}. In some instances, risks remain a concern even after day 14 which is the usual retreatment interval. In these cases, EPA calculated the day of entry that would achieve cancer risk estimates less than 10^{-6}. If the calculations indicate, for example, that cancer risks reach 10^{-6} on day 30, that means that the *average* or *typical* day of entry would need to be DAT 30 to reach that risk level. That should not be interpreted as an REI of 30 days, but rather as a range-finder calculation.

HED believes that postapplication inhalation exposure will be minimal because of the high dilution one would expect outdoors and the relatively low vapor pressure of thiophanate-methyl (1.3×10^{-5} millimeters of mercury). In addition, the Worker Protection Standard for Agricultural Pesticides prohibits entry by workers until at least 4 hours following application and until any ventilation or inhalation requirements have been met. All of the estimated MOEs represent a worker entering a field with long-sleeved shirt and long pants.

Based on the anticipated thiophanate-methyl use patterns and current labeling, postapplication dermal exposure scenarios were modeled using standard transfer coefficients and the chemical-specific dislodgeable foliar residue dissipation data described above. These assessments were based on the guidance provided in the OPPTS Series 875 Guidelines. Tables 11a through 14a present the scenarios and the detailed results of the quantitative occupational postapplication non-cancer risk assessment.

Postapplication risks are mitigated for crop advisors/scouts using entry restrictions, not restricted-entry intervals. Under the Worker Protection Standard for Agricultural Pesticides -- 40 CFR Part 170, crop advisors/scouts are defined as handlers, the Agency permits such persons to enter treated areas to perform scouting tasks, provided they use the personal protective

equipment required for handlers. Additionally, the crop advisor exemption allows certified or licensed crop advisors to choose appropriate protection to be used while performing crop advising tasks in treated areas for themselves and for their employees. However, the WPS exemption does not exempt crop advisors from regulation under FIFRA-Sections 3, 6, and 12, and Title 40 CFR Part 156.204(b)-Labeling in regard to risk concerns identified through reregistration or other EPA risk assessment /data evaluations processes.

2.2.4 Post-Application Cancer Risk Estimates

Cancer risks are estimated for post-application workers in a similar fashion to the method described for handlers in section 2.1.4. The LADD is determined using the number of days per year that the worker is estimated to contact foliage while working with the particular crop. Thus the LADD formula is modified using the dermal dose as calculated previously:

$$\text{LADD} = \frac{\text{Dermal Dose (mg/kg/day)} * \text{ED (Days/Year)} * 35 \text{ work years}}{365 \text{ days/year} * 70 \text{ year lifetime}}$$

ED = Exposure Duration

The HED estimates of post-application worker cancer risk are presented in Tables 11b-14b. The days worked per year are considered reasonable best estimates based upon data obtained from USDA, growers, and agricultural economists and other experts within the Biological and Economic Assessment Division (BEAD). Conservative estimates, based on available agricultural re-entry surveys (including the ARTF), indicate that workers may harvest various field crops for 90 or more days per year, with the greatest activity occurring during a 30-day period for each crop. Workers may harvest more than one crop per season, or in more than one location, or different crops; however, many workers now specialize in a particular crop. Strawberry pickers may spend up to 180 days per year picking fruit. Many fruit pickers specialize and may pick fruit over a large region, increasing their time spent harvesting. A typical average time spent harvesting any one treated field, based on field crew and treated field estimated size, is anticipated to be about 7 days. Therefore, a seven-day post-application average of the foliar residues is more realistic for the purpose of estimating lifetime cancer risk, while still assuming a high number of days in the field and years working at one task. The average time that a harvester works in California is 5.35 years based upon a recent UC Riverside survey of growers who gave work history summaries for a total 15,035 workers. The workers represented all areas of the state where strawberries are commercially grown. The standard HED assumption is 35 years working in the field, and is considered highly conservative.

2.2.5 Summary of Post-Application Non-cancer and Cancer Risk Estimates

Postapplication Risk Estimates Based on Apple Data: Estimates of postapplication risks to workers involved in tasks related to the production of tree fruits and nuts, grapes, and woody ornamentals were assessed using thiophanate-methyl specific data from an apple study (see Tables 11a & 11b. Since the data gathered from the state of Washington (WA) differed substantially from the data gathered from the state of New York (NY), risks are estimated separately using data from the two sites. Since no long-term (chronic) exposures are expected, short- and intermediate-term non-cancer risks and cancer risks are estimated based on dermal exposures.

The results indicate that short- and intermediate-term dermal exposures for apple, cherry, nectarine, apricot, plum and prune workers result in non-cancer risk estimates that exceed the level of concern (MOE < 100) for thinning tasks until day 6 after treatment using NY data and until day 28 using WA data. For hand pruning, propping, and harvesting tasks in these crops, MOEs remain less than 100 until day 1 using NY data, but MOEs are > 100 at day 0 (12 hours following application) using WA data. The MOEs are greater than 100 after day 0 (12 hours following application) for scouting and irrigating tasks. Cancer risk estimates for apple workers are 2.7×10^{-5} using NY data and 5.7×10^{-5} using WA data when entry is averaged from day 1 to day 14. Cancer risk estimates for cherry, nectarine, apricot, plum and prune workers are 2.0×10^{-5} using NY data and 4.3×10^{-5} using WA data when entry is averaged from day 1 to day 14.

The results indicate that for peach workers, short- and intermediate-term non-cancer risk estimates exceed the level of concern for thinning tasks until day 8 using NY data and until day 56 using WA data. For hand pruning, propping, and harvesting tasks in peaches, MOEs are < 100 until day 3 using NY data and until day 14 using WA data. The MOEs are >100 after day 0 (12 hours following application) for scouting, hand weeding, and irrigating tasks. Cancer risk estimates for peach workers are 2.7×10^{-5} using NY data and 5.6×10^{-5} using WA data when entry is averaged from day 1 to day 14.

The results indicate that for almond workers, short- and intermediate-term non-cancer risk estimates exceed the level of concern for hand harvesting, pruning, and thinning tasks until day 1 using NY data and until day 7 using WA data. The MOEs are >100 after day 0 (12 hours following application) for scouting, thinning, and irrigating tasks. Cancer risk estimates for almond workers are 2.3×10^{-5} using NY data and 4.8×10^{-5} using WA data when entry is averaged from day 1 to day 14.

The results indicate that for pecan workers, short- and intermediate-term non-cancer risk estimates do not exceed the level of concern for any postapplication tasks after day 0 (12 hours following application). Cancer risk estimates for pecan workers are 1.5×10^{-5} using NY data and 2.9×10^{-5} using WA data when entry is averaged from day 1 to day 14.

The results indicate that for pear workers, short- and intermediate-term non-cancer risk estimates exceed the level of concern for thinning tasks until day 4 using NY data or DAT 14 using WA data. For hand pruning, training, tying, harvesting, scouting, irrigating, and weeding tasks in

pears, MOEs are >100 after day 0 (12 hours following application). Cancer risk estimates for pear workers are 1.6×10^{-5} using NY data and 3.4×10^{-5} using WA data when entry is averaged from day 1 to day 14.

The results indicate that for grape workers, short- and intermediate-term non-cancer risk estimates exceed the level of concern for girdling and cane turning tasks until day 8 using NY data and until day 28 using WA data. For hand harvesting, leaf pulling, thinning, training, and tying tasks in grapes, MOEs are <100 until day 4 using NY data and until day 14 using WA data. For scouting and irrigating tasks, MOEs are >100 after day 0 (12 hours following application). Cancer risk estimates for grape workers are 7.9×10^{-5} using NY data and 1.7×10^{-4} using WA data when entry is averaged from day 1 to day 14. Cancer risk estimates are 1.0×10^{-6} at day 29 using NY data and 3.5×10^{-5} at day 84 (the last data point using actual WA data).

The results indicate that for workers performing tasks with woody ornamentals, short- and intermediate-term non-cancer risk estimates exceed the level of concern for hand harvesting, transplanting, pruning, and pinching tasks until day 11 using NY data and until day 84 using WA data. For scouting and irrigating tasks in woody ornamentals, MOEs are >100 on day 0. Cancer risk estimates for such workers are 1.1×10^{-4} using NY data and 1.6×10^{-4} for WA data when entry is averaged from day 1 to day 14. Cancer risk estimates are 1.2×10^{-6} at day 30 using NY data and 3.4×10^{-5} at day 84 using WA data.

Postapplication Risk Estimates Based on Cut Flower Data: Postapplication risks to greenhouse workers were assessed for workers involved in tasks related to the production of cut flowers and for workers involved in tasks related to other herbaceous ornamentals (see Tables 12a & 12b). Since greenhouse operations are typically year around and thiophanate-methyl can be reapplied at frequent intervals, and residues were shown to dissipate slowly, EPA believes that workers may be exposed for 180 days or longer, therefore long-term (chronic) exposure and risks were also assessed. For greenhouse workers, the short- and intermediate-term non-cancer risk estimates exceed the level of concern (MOE <100) until day 48 after treatment, based on the average dermal transfer factor from a study of thiophanate-methyl reported in published literature. Long-term MOEs were less than 100 for nearly as long postapplication as short- to intermediate-term MOEs. Cancer risk estimates were also a concern for these workers. The cancer risk estimates when the reentry is averaged from day 1 to day 14 are 4.3×10^{-4} for typical activities for cut flower workers and 3.8×10^{-4} for irrigating and scouting herbaceous ornamentals. Cancer risk estimates are approximately 10^{-6} at 155 days after treatment for irrigating and scouting greenhouse ornamentals.

Postapplication Risk Estimates Based on Strawberry Data: Postapplication risks to workers involved in tasks related to the production of nonwoody outdoor crops (other than turf) were estimated using thiophanate-methyl specific data from a strawberry study. Since the data from the strawberry study sites were substantially similar, data were averaged among the sites and a single value is presented. Tables 13a & 13b summarize postapplication exposures and risk estimates to occupational workers performing tasks on nonwoody outdoor crops (other than turf).

The results indicate that for strawberry workers, short-, intermediate-, and long term risk estimates do not exceed the level of concern (MOE >100) for any tasks at day 0 (12 hours) following application. Since EPA believes that strawberry workers may be exposed 180 or more days a year by migrating with the ripening strawberry fields, long-term (chronic) risk estimates also were assessed for strawberry workers. Cancer risk estimates for strawberry workers are 1.1×10^{-5} when entry is averaged from day 1 to day 14.

The results indicate that for wheat workers, short- and intermediate-term risk estimates did not exceed the level of concern for any tasks at day 0 (12 hours) following application. Cancer risk estimates for wheat workers are 1.1×10^{-6} when entry is averaged from day 1 to day 14.

The results indicate that for cucurbit workers, short- and intermediate-term risk estimates did not exceed the level of concern for any tasks at day 0 (12 hours) following application. Cancer risk estimates for cucurbit workers are 3.6×10^{-6} when entry is averaged from day 1 to day 14.

The results indicate that for sugar beet workers, short- and intermediate-term risk estimates do not exceed the level of concern for any tasks at day 0 (12 hours) following application. Cancer risk estimates for sugar beet workers are 1.1×10^{-6} when entry is averaged from day 1 to day 14.

The results indicate that for soybean workers, short- and intermediate-term risk estimates do not exceed the level of concern for any tasks at day 0 (12 hours) following application. Cancer risk estimates for soybean workers are 3.2×10^{-6} when entry is averaged from day 1 to day 14.

The results indicate that for bean workers, short- and intermediate-term risk estimates exceed the level of concern until day 1 following application for hand harvesting tasks, but do not exceed the level of concern for scouting, irrigating, or thinning tasks at day 0 (12 hours) following application. Cancer risk estimates for bean workers are 7.7×10^{-6} when entry is averaged from day 1 to day 14, but less than 10^{-6} if reentry occurs an average of 7-14 days after treatment.

The results indicate that for potato workers, short- and intermediate-term risk estimates exceed the level of concern until day 1 following application for hand harvesting tasks, but do not exceed the level of concern for scouting, irrigating, or thinning tasks at day 0 (12 hours) following application. Cancer risk estimates for potato workers are 7.7×10^{-6} when entry is averaged from day 1 to day 14, but less than 10^{-6} when reentry is an average of 7-14 days after treatment.

The results indicate that for workers involved in the outdoor production of herbaceous ornamentals, short- and intermediate-term risk estimates exceed the level of concern for scouting and irrigating tasks until day 1 following application and until day 3 following application for hand harvesting, pruning, thinning, and transplanting tasks. Cancer risk estimates for these workers are 1.2×10^{-4} when entry is averaged from day 1 to day 14. The cancer risk estimate for workers is greater than 10^{-6} until 16 days after treatment.

Postapplication Risk Estimates Based on Turf Data: Postapplication exposures and risks to workers on sod farms and golf courses were estimated based on dermal exposures to transferable

residues from a turfgrass study. Since the data from the Pennsylvania site (which received no rainfall or irrigation) differed remarkably from the data from the California and Georgia sites, one risk assessment is based on the Pennsylvania data (PA), representing non-irrigated turf, and the other based on the average TTR data from the California and Georgia data (CA/GA), representing irrigated turf, which is the more typical practice. Tables 14a and 14b summarize postapplication exposures and risk estimates to occupational workers performing tasks on turf.

The short- and intermediate-term risks to sod farm and golf course workers doing hand harvesting, transplanting, and hand weeding tasks exceed the level of concern until day 2 after treatment for irrigated turf (CA/GA data) and until day 7 for non-irrigated turf (PA data). For other tasks, including seeding, scouting, mechanical weeding, aerating, fertilizing, mowing, etc., the short- and intermediate-term risk estimates are less than the level of concern on day 0 starting approximately 12 hours after application. Cancer risks for sod farm workers are assessed using the transfer coefficient for hand harvesting, transplanting, and hand weeding tasks, since these tasks likely compose a substantial part of sod farm worker's activities over a year. Cancer risks for golf course workers are assessed using the transfer coefficient for mowing, scouting, aerating, fertilizing, etc., since these are likely the main tasks for such workers. Cancer risk estimates for sod farm workers are 3.9×10^{-5} using PA data and 1.3×10^{-5} using the CA/GA data when the DFRs are averaged between day 1 and day 14. Cancer risk estimates for such workers reach 10^{-6} on the 28th day of after application using PA data and on the average of day 8 to day 14 data from CA/GA sites. Cancer risk estimates for golf course workers are 1.2×10^{-6} when the (higher) average of day 1 to day 14 from the PA data is used to predict worker.

Post-application exposure to treated seed while planting

The handler of treated seed would not be loading the thiophanate-methyl product, but dust from the treated seed may present a somewhat lower hazard. As there are no data available to assess this specific scenario, the estimate of exposure during treatment and planting of potato seed pieces (section 2.1.2) is used as a (conservative) surrogate for high-end exposure from handling of treated seed. Unfortunately, the data used to assess treatment of seed pieces was collected while handlers were wearing gloves, therefore the assessment does not directly parallel loading treated seed without the use of gloves.

Post-application exposure to MBC residues

A worker post-application exposure scenario was also assessed for the metabolite of thiophanate-methyl, MBC. The same assumptions as for thiophanate-methyl were used along with the maximum MBC DFR for each study. The highest MBC DFR value was used because of the uncertainties in the percentage of thiophanate-methyl that degrades to MBC at any time in the environment, as well as the dissipation rate of MBC (which increases before decreasing after thiophanate-methyl application). The risk assessment indicates that non-cancer risks to postapplication workers do not exceed the level of concern (MOE >100) from exposures to MBC residues as a degradate of thiophanate-methyl. For short-term risks, the MOEs range from 250 to 630,000 with a target of 100. Table 15 summarizes the exposure and risk estimates. Cancer

risk estimates range from 4.4×10^{-6} to 1.9×10^{-8}. The MBC exposure do not contribute significantly to the total cancer risk from thiophanate-methyl.

2.2.6 Summary of Post-Application Risk Concerns, Data Gaps, and Confidence in Estimates

Chemical-specific post-application worker exposure data were not available. There is little data available on post-application exposure to treated seed or seedlings, or from sorting and packing treated vegetables, particularly in the field. Insufficient data are available to characterize exposures to treated soil due to cultivating or transplanting activities, particularly after soil drench and soil broadcast applications. Exposure data, preferably chemical-specific, is needed in the following categories to better characterize post-application worker risks:

OPPTS Guideline No.	Study	Crop
875.2400	Dermal exposure	Handling treated seed & seedlings; field sorting and packing treated crops; cultivating and transplanting in treated soil.
875.2500	Inhalation exposure	" "
875.2600	Biological monitoring	" "
875.2800	Descriptions of human activity	" "

Standard transfer coefficients were used to estimate potential exposures and doses for workers entering treated fields for various tasks. The standard transfer coefficient values are based on published empirical data including proprietary data from ARTF and other studies and are generally considered by HED to represent reasonable estimates of dermal exposure. The translation of transfer coefficients from one crop to another increases uncertainty in the risk assessment. The highest confidence is in use of turf TTR data for turf and sod. There is fairly high confidence in the translation of the apple data to other orchard crops. Greenhouse crops may not be equally well represented by translation of the cut-flower transfer coefficient, but the thiophanate-specific greenhouse Tc, in combination with the residue data, present an average-to-high estimate. Greenhouse and nursery employees may also work less than 8 hours per day in such activities. There is lower confidence in the translation of strawberry DFR data to field crops. Strawberry foliage may be lower and more subject to the effects of irrigation than taller crops, which may cause residues on strawberry leaves to dissipate more quickly. The Tcs for each crop and activity are central-tendency, but the assumptions of 35 years worked, 8 hour days, and DAT 0 or DAT 1 residue exposure each day raise the estimates. Elf-Atochem Corp. is a member of the ARTF. Submission and review of additional ARTF study data could change the post-application occupational risk assessment results for thiophanate-methyl.

2.3 OCCUPATIONAL RISK CHARACTERIZATION

2.3.1 Handler Characterization

The risk estimates were based on surrogate chemical handler data and standard assumptions for daily use rates. Most of the data used were central tendency, while the application rates, areas, and quantities handled per day were based on label maximums or high-end estimates. Therefore, the short- and intermediate-term exposure estimates are considered protective of most handlers, but do not cover outliers and accidental overexposure. Short to intermediate term risk estimates generally exceeded the HED's level of concern until gloves, and in some cases coveralls and respirators were added. Although cancer risk estimates were generally greater than 10^{-6} for private and commercial mixer/loaders at baseline, most were mitigated with PPE or engineering controls to 10^{-6}. The standard assumption of 35 years for working lifetime using a single chemical is considered conservative or high-end. The days per year handlers are exposed to thiophanate-methyl were estimated using label information and limited BEAD and registrant submitted information. Each scenario was considered individually, but exposure days are expected to vary seasonally, geographically, and with disease pressure. These mitigating factors were considered, and the estimated days of exposure are considered more typical than high-end. This assessment could be refined with additional use data.

2.3.2 Post-Application Characterization

The registrant has conducted and submitted several post-application residue studies, which are very helpful in conducting a risk assessment. The greenhouse risk assessment was based on the cut flower residue study conducted by Elf-Atochem and well-documented transfer coefficients from the Brouwer, et al. studies, adjusted for a range of greenhouse activities. The persistence of the thiophanate-methyl residues in greenhouses was also supported by the published literature. Harvesting tree crops also had risks greater than the level of concern for long periods after treatment, which may impact on harvesting (depending on application timing), particularly in dry climates such as Washington state. The postapplication risk estimates for all field and vegetable crops were based upon the strawberry residue data. Because strawberries are low-growing (subject to dew) and are a well irrigated crop, residues may be somewhat less persistent than on taller crops. Therefore, there is somewhat less confidence in the translation of the strawberry data to taller crops. However, by using the study data and crop-specific transfer coefficients, a continuum of exposure estimates was obtained. The turf and sod estimated risks are based on crop-specific TTR studies and therefore considered to be of a higher confidence level. Non-irrigated turf had longer residue persistence than irrigated turf. Postapplication cancer risk estimates have relatively low confidence because of limited and highly variable information provided on use frequency and frequency of reentry after thiophanate-methyl application. Every effort was made to determine typical exposures, so the cancer risk estimates are not considered high-end.

3.0 RESIDENTIAL AND OTHER NON-OCCUPATIONAL EXPOSURES AND RISKS

This assessment for thiophanate-methyl reflects the HED's current approaches for completing residential exposure assessments based on the guidance provided in the Draft: Series 875-Occupational and Residential Exposure Test Guidelines, Group B-Postapplication Exposure Monitoring Test Guidelines, the Draft: Standard Operating Procedures (SOPs) for Residential Exposure Assessment, and the Overview of Issues Related to the Standard Operating Procedures for Residential Exposure Assessment presented at the September 1999 meeting of the FIFRA Scientific Advisory Panel (SAP).[18,19,20] The HED is, however, currently in the process of revising its guidance for completing these types of assessments. Modifications to this assessment shall be incorporated as updated guidance becomes available. This will include expanding the scope of the residential exposure assessments by developing guidance for characterizing exposures from other sources already not addressed such as from spray drift; residential residue track-in; exposures to farm worker children; and exposures to children in schools.

Potential non-occupational handler and post-application exposure to the environmental degradate of thiophanate-methyl, MBC, was also considered. Because the toxicological non-cancer endpoints for MBC and thiophanate-methyl are different, the potential doses from the different chemicals are not added together in this assessment. The cancer risk estimates may be added, however, as both chemicals produce similar tumors. The levels of concern for non-cancer exposure are MOEs of 300 and 1000 for thiophanate-methyl and MBC, respectively. Residential cancer risk estimates greater than 10^{-6} exceed the level of concern for either chemical. As stated in the occupational risk assessment, the submitted DFR studies indicate that MBC residues occur in very low concentrations relative to thiophanate-methyl, rise slowly over time, but never exceed the level of the parent compound until no longer detectable. For the residential handler, only thiophanate-methyl exposure was considered due to very low initial concentrations of MBC. Although very low, the potential post-application daily dosage from exposure to the maximum MBC residues were calculated to assist the risk assessors and risk managers in defining the overall risk of exposure to products containing thiophanate-methyl (Table 15). Only potential dermal exposures were considered because all activities were outdoors for homeowners and the vapor pressure of MBC is very low, so inhalation is considered an insignificant route of exposure. The active ingredient MBC is also used as a paint additive, exposure to which is unlikely to coincide with other residential uses of thiophanate-methyl, which are primarily outdoor and agricultural. Exposure risk estimates for use of MBC as active ingredient are contained in a separate document, *Occupational and Residential Exposure Assessment and Recommendations for the Risk Assessment Document for MBC*.[20]

3.1 Residential Handler Exposures and Risks

3.1.1 Residential-Handler Exposure Scenarios, Data, and Assumptions

Residential handlers are involved in the entire pesticide application process (i.e., they do all job functions related to a pesticide application event). The only significant difference between this category and the similar occupational category is that the individuals typically use less chemical

on a daily basis and residents are assumed to wear baseline attire consisting of short-sleeve shirt, short pants, shoes, and socks. EPA does not consider it feasible to require personal protective equipment or engineering controls for residential handlers. Only short-term dermal and inhalation exposures (less than one week) are anticipated for residential handlers of thiophanate-methyl products, but these exposures may be aggregated with potential postapplication exposures, where appropriate.

Uses by Residents:

Labels indicate and registrants confirm that thiophanate-methyl is available for use by residential handlers as liquid, wettable powder, and granular formulations and is applied using hose-end, low pressure handwand, and backpack spray equipment, push-type and bellygrinder granular spreaders, and by dispersing the granules by hand. (Note: The granular residential use label does not specify hand use for spot treatment, but only recommends application rates by spreader, and, in one case, states "do not apply by hand" [reg. No. 538-140]). If hand broadcast application is to be prevented, the labeling should so specify. Also, the wettable powder formulation may not be intended for consumer use, but in that case it needs to be specifically labeled "for professional use only."

No chemical-specific data were submitted for residential handler risk assessment, so the PHED values were used, as cited in the draft SOPs for Residential Exposure Assessments. In addition, since PHED data for the equipment-types used by residential handlers is generally of low quality, EPA used data recently received from the ORETF to assess risks using hose-end sprayers and push-type spreader. For all residential equipment, the exposure estimates assume that individuals wear short pants, short sleeves and no gloves. The estimates were performed in a similar manner to the occupational scenarios described in Section 2.1.2, but using the parameters in the residential SOPs:

- Turf treatment to full lawn: 0.5 acre per day
- Turf spot-treatment: 0.025 acre per day (approximately 1000 ft^2)
- Ornamental broadcast treatment: 0.25 acre per day
- Ornamental spot treatment: 5 gallons per day for spray; 0.025 acre for granular

These standard assumptions were adjusted based on labels, such as label rates that were so high as to practically preclude treatment of an entire lawn.

Inhalation and/or dermal potential dose rates are calculated as follows:

PDR = UE x AR x A

PDR = potential dose rate (mg/day)
UE = unit exposure (PHED or study data) mg/lb ai
AR = maximum application rate (lb ai/acre)
A = maximum area treated (acres/day)

3.1.2 Resident-Handler Exposure and Non-Cancer Risk Estimates

Potential residential exposures are anticipated as a result of residential application. Resident usage patterns have been estimated based on label application frequency, estimated seasonal length (only the wetter part of the full growing season), and persistence of thiophanate-methyl. It is estimated thiophanate-methyl could be applied 5 times in a season, each representing a single short-term exposure. Table 16 shows the exposure and risk estimates for residents handling thiophanate-methyl.

Since the adverse effect is similar for dermal exposures and for inhalation exposures, the risks are aggregated. The results of the aggregated risks closely mirror the results of the dermal risk assessment, since inhalation exposures did not exceed the level of concern -- for those scenarios where short-term *dermal* residential handler risks exceed the target MOE, the short-term *total* risks also exceed the target MOE and for those scenarios where short-term *dermal* residential handler risks were $ 300, the short-term *total* risks also have MOEs $300. The results of the risk assessment indicate that short-term risks from thiophanate-methyl inhalation exposures *alone* for residential handlers do not exceed the level of concern regardless of the type of application method used. The inhalation MOEs range from 1,700 to 670,000, with a target MOE of 300.

The risk assessment indicates that dermal and total non-cancer risk estimates for residential handlers exceed the HED's level of concern for four scenarios involving application to lawns, either broadcast or spot-treatment. The total dermal plus inhalation risk estimates are:

- mixing, loading, and applying liquid with a hose-end sprayer (MOE = 84),
- mixing/loading/applying liquid (MOE = 190) and wettable powder (MOE = 72) formulations with a low pressure (pump) handwand sprayer,
- loading/applying granular formulation with a bellygrinder (MOE = 230), and
- hand dispersal of granules (MOE = 58).

Total dermal and inhalation exposures for residents applying thiophanate-methyl granular formulations (i.e., weed and feed) via push-spreader or liquid formulations by hose-end sprayer (ready to use) did not exceed the level of concern. Exposures while applying thiophanate-methyl to ornamentals by spreader or sprayer did not exceed the level of concern.

3.1.3 Resident-Handler Cancer Risk Estimates

The lifetime average daily dose (LADD) for use in the cancer assessment was calculated using the following formula:

LADD (mg/kg/day) =
Daily Total Dose (mg/kg/day) * (days worked/365 days per year) * (50 years worked/70 year lifetime)

where: Daily Total Dose (mg/kg/day) =
[Daily Dermal Dose (mg/kg/day) * Absorption factor] + Daily Inhalation Dose (mg/kg/day)

Dermal absorption adjustment is necessary for the cancer assessment because the cancer endpoint is based on oral feeding studies. A dermal absorption factor of 7 percent, and an inhalation absorption factor of 100 percent are used in the calculations.

The number of years typically working in the home garden (50) and lifetime (70 years) are population standards used in numerous risk assessment documents and guidelines, including the EPA's Exposure Factors Handbook. Residential-applicator usage patterns have been estimated based on label application frequency (every 2 weeks to monthly), estimated seasonal length (spring/summer), and persistence of thiophanate-methyl. Lacking specific data from residential user surveys, it is estimated from most labels that thiophanate-methyl could be applied up to 5 times in season, assuming only part of summer would be the period of concern. Cleary, Co. has indicated up to six commercial applications may be needed for some cases. However, according to Elf Atochem, typical residential use is once per season. Owing to the mostly conservative assumptions used in the cancer risk estimate, the typical rate of once yearly was used for the resident handler risk estimate.

Cancer risk is calculated using the following formula:

$$\text{Risk} = \text{LADD (mg/kg/day)} * Q_1^* \text{ (mg/kg/day)}^{-1}$$

The risk assessment indicates that lifetime cancer risk estimates for residential handlers range from 4.5×10^{-6} to 3.4×10^{-8} for applications to lawns and from 2.5×10^{-7} to 5.2×10^{-9} for applications to ornamentals when the registrant-submitted typical application frequency of once per year is used. The cancer risk estimates only exceed 10^{-6} for two less common scenarios: mixing and loading liquids for low pressure hand wand (4.5×10^{-6}) and hand dispersal of granules (3.2×10^{-6}). While more frequent applications may be necessary in a single season when a heavy infection occurs, other years may require no treatment, and an average of once per year is deemed reasonable for estimating lifetime cancer risk.

3.1.4 Summary of Risk Concerns for Residential Handlers, Data Gaps, and Confidence in Exposure and Risk Estimates

In general, short-term risk estimates for residential handlers exceed HED's level of concern for about half of the formulations and equipment scenarios determined. Cancer risks were less than 10^{-6} for only two, less common scenarios: using a liquid to mix and apply product with a hose-end sprayer, and dispersing granular formulation by hand

.

Data confidence levels are described in Table 23. It is assumed handler exposure is short term, probably a single day at a time. The data used were mostly from high-quality recent studies submitted by the ORETF. Central tendency exposure data were used together with label maximum rates for short-term exposures, so the assessment is considered protective of most uses but not conservative. As described above, without user survey data the "typical use" cannot be accurately estimated. Therefore there is greater confidence in short term risk estimates than in the cancer risk estimates. While the number of year of use (50) is considered conservative, the

use of a single application per year, on average, yields a lifetime exposure based on 50 applications, so the overall handler cancer risk estimate is considered realistic rather than conservative.

3.1.5 Recommendations

Current labeling does not clearly specify which products containing thiophanate-methyl are for professional use only. Specific labeling would help eliminate unintentional use by residents. Labeling should also specifically advise against hand application methods.

3.2 NON-OCCUPATIONAL POST-APPLICATION EXPOSURE AND RISK ESTIMATES

3.2.1 Post-Application Exposure Scenarios, Data, and Assumptions

Two groups, adults and children, are potentially exposed to thiophanate-methyl or MBC residues after application of thiophanate-methyl products in residential settings. After application to turf or home orchards, short- to intermediate-term dermal exposures are anticipated for adults and children (small children are not expected to pick a significant amount of fruit, but youths 10-12 years old are included). Incidental oral exposure is also expected to occur for small children and is aggregated with their dermal exposures, where applicable (i.e., playing on turf). Representative, range-finding activities include harvesting fruit, working and playing on turf, mowing, golfing, and incidental ingestion by children. Therefore, the thiophanate-methyl post-application exposure/risk assessment contains exposure scenarios in each category. The physical, behavioral, and physiological differences between adults and children are continuously being studied by the Agency and many others, and the current standard assumptions set forth by the HED and the Science Advisory Panel (SAP) are contained in the aforementioned Residential SOPs. The SOPs were updated in February, 2001 to reflect the latest research findings and refined assessment strategies since the presentation to the SAP in September 1999.

Wherever available, reported usage data are used in this process to define values such as application rates and application frequency. However, such data were not available for nonoccupational uses. The registrant Elf Atochem has submitted a typical rate of 2.7-5.4 lb ai/acre for LCO lawn applications, and a maximum of 6 applications per season by LCOs. However, the registrant also cited a Professional Lawn Care Association of America survey, stating that LCOs only treat about 12% of all turf for disease is treated annually. This information, while not chemical-specific, was considered in determining “typical” residential exposures for the purpose of estimating cancer risks. The HED always completes short- and intermediate-term risk assessments using maximum application rates for each scenario because what is possible under the label (the legal means of controlling pesticide use) must be evaluated for complete stewardship in order to ensure the HED has no concern for the specific use. Additionally, whenever the HED has specific use information, such as typical application rates or application frequencies, it uses the information to evaluate the cancer risks associated with the use of the chemical.

As a result of ornamental, fruit tree, golf course, and recreational and home lawn chemical uses, the HED does have concerns for potential exposures to both adults and children. In order to adequately consider the risks to children, the guidance from the HED's updated Residential SOPs was used to address the exposures of children contacting recently treated turf, ornamentals, or fruit trees. The SOPs use a high contact activity based on the use of Jazzercise® to represent the exposures of an actively playing child or active adult. Lower-contact activities, such as walking, mowing, or golfing, for example, use transfer coefficients based on mowing studies.

The HED believes that thiophanate-methyl and MBC exposures can occur over a single day or up to weeks at a time even though established turf and ornamentals are generally treated only once per season. This is supported by the length of time that residues took to decline in the thiophanate-methyl strawberry and turf DFR studies submitted and the fact that several areas may be treated at different times. For example, a lawn or a golf course might be treated over several weeks. The HED classifies these as short-term exposures (one-week or less) and intermediate-term exposures (seven days to several months), respectively. No long-term (six months or more) residential exposures are associated with the use of thiophanate-methyl, due to the product's use pattern and dissipation rate. These classifications are the basis for selecting toxicological endpoints for chemicals and are generally included in each risk assessment. Inhalation exposures are thought to be negligible in outdoor post-application scenarios because of the low vapor pressure of thiophanate-methyl and MBC and because the uses (and primary exposures) are outdoors allowing for significant dilution. As such, inhalation exposures are not considered in the post-application exposure assessment. Although MBC postapplication residues were low, short- to intermediate-term dermal residential exposures and risks were estimated for the purpose of chemical-specific and aggregate dose and risk determinations. Route-specific (i.e., dermal and incidental oral) thiophanate-methyl and MBC exposures were aggregated for each chemical individually, but the total exposure to the two chemicals is not aggregated in this assessment due to the different toxic endpoints. Because both chemicals produce liver tumors, the total postapplication cancer risks are aggregated, as shown in Table 4.

Restricted entry intervals are not considered a practical regulatory tool for reducing exposures and risks in the residential environment (i.e., for the general population). Although LCOs may inform residents to stay off treated turf, or signs may be posted, there is no practical way to restrict access by humans or pets. Therefore, for chemicals used in the residential environment or any other areas where the general population can be exposed, the HED currently considers the risks associated with a chemical on the day they are applied.

The TTR data from the turf study submitted were found to be acceptable for use in postapplication exposure assessment. A range of application rates, derived from thiophanate-methyl product labeling, was used as the basis for this assessment (i.e., a ratio of rates is used to adjust the TTR data from the study). The exposure estimates are inclusive of all label rates, but for practical reasons show three rates: 11, 15, and 19 lb ai/acre which represent the higher end for granular, liquid (or solubles), and ready-to-use formulations, respectively. The typical rate suggested by the registrants of 5.4 lb ai/acre was used for cancer risk estimation. Apple study DFR data were used to determine post-application residential fruit harvesting exposure.

Information was received from Cleary Chemical Corporation regarding the size and distribution of granular formulations they manufacture. This information is helpful in refining or characterizing the estimate of potential risk from episodic incidental ingestion of granules beyond the current screening level. For example, the "weed and feed" (fertilizer/herbicide combination) granules would be considered more attractive and more likely to be consumed if readily visible and easily picked up by a child. The Cleary product information, provided electronically on October 5, 2000, indicates a particle diameter range of 0.7 to 1.2 mm for their granular 3336G formulation. If evenly distributed, individual grains would be difficult to pick up, or even to see when applied on a lawn and if used according to label directions and soil incorporated by watering in. Therefore, given proper application this product would be difficult for a small child to grasp and then mouth or ingest. However, larger granules or pellets of a few millimeters diameter might be attractive and easily picked up by a young child. No data was available on other granular formulations. Based on a bulk density of 30 lbs/cubic foot for the 2% 3336G, one teaspoon of product would contain 240 mg of active ingredient. This amount, if mouthed and swallowed by a small child, 480 times higher than the toxic level of concern. Therefore HED recommends that the potential for children's exposure to Atrazine granules be mitigated through stringent label requirements for watering-in and spill clean-up.

Exposure Scenarios and Assumptions:

(1) Adults are involved in a low exposure activity, such as golfing, for 4 hours a day with an exposure frequency of 5 days per year for 50 years. This assumes the average golfer plays 18 times per year but the turf is treated 5 times, and the golfer is exposed to the average residues between applications every two weeks.
(2) Adults are involved in mowing or other low exposure activity for 2 hours per day with an exposure frequency of 2 days per year for 50 years. This assumes that, as the registrant suggests, the lawn is treated once annually on average, and it is mowed weekly within the two week period of highest residues postapplication, and therefore the mower is exposed to average residues twice in two weeks.
(3) Adults are involved in a high exposure activity, such as heavy yard work or gardening for 2 hours per day with an exposure frequency of 14 days per year for 50 years. This is the number of days the turf residues will take to decline after application, and an average residue exposure is assumed for cancer risk estimates.
(4) Small children are involved in high exposure activities on turf for 2 hours per day on the same day pesticide is applied.
(5) Adults are involved in harvesting treated fruit in a home orchard for 40 minutes (0.67 hour) per day with a frequency of 5 days per year for 50 years.
(6) Children 10-12 years old are involved in harvesting treated fruit in a home orchard for 20 minutes (0.33 hour) per day.

Small children's exposure levels were calculated for the residential exposure assessment and for the purposes of completing an aggregate risk assessment that also considers exposure from dietary intake of food and water (for all age groups).

Dermal exposure values for adults and children on each day after application were calculated based on the following equation (see Residential SOP 2.2: Postapplication dermal potential dose from pesticide residues on turf):

$DE_{(t)}$ (mg/day) = ($TTR_{(t)}$ (Fg/cm^2) x TC (cm^2/hr) x Hr/Day)/1000 (Fg/mg)

Where:

DE	=	Dermal exposure at time (t) attributable for activity in a previously treated area (mg/day);
TTR	=	Turf Transferable Residue at time (t) where the longest duration (t) is dictated by the kinetics observed in the TTR study;
TC	=	Transfer Coefficient; and
Hr	=	Exposure duration in hours.

As MBC residues are so low, and the turf residue exposure calculations are based on only 2 data points above the level of quantitation, all MBC short- to intermediate-term turf exposures were estimated based on the highest daily average TTR value.
The activities that were selected as the basis for the risk assessment are represented by the following transfer coefficients (for short-term endpoints):

- Adults involved in a low exposure activity on turf such as golfing, mowing, or other light work activities - transfer coefficient = 500 cm^2/hour;
- Adults involved in a high exposure activity on turf such as heavy yardwork or laying sod - transfer coefficient = 14,500 cm^2/hour (short-term activities); 7300 cm^2/hour (Intermediate-term activities; this factor is also used for cancer risk estimates)
- Small children involved in a high exposure activity - transfer coefficient = 5,200 cm^2/hour (based on the proposed changes to the residential SOPs (12/99);
- Adults harvesting fruit - transfer coefficient (adult) = 10,000 cm^2/hour, based on Residential SOP 4.2.
- Youth (10-12 years) harvesting fruit - transfer coefficient = 5,000 cm^2/hour, based on Residential SOP 4.2. Teenagers who are more than 12 years old are believed to have approximately the same exposure rate/body weight as adults. This is based on empirical data which consistently shows the transfer coefficients are lower for children performing the same tasks in agriculture as adults.

The HED's Residential SOPs contains guidance for considering children's exposure to treated turf. The dermal calculations, as noted above, were completed based on the guidance provided in the document. All nondietary exposures were also calculated using guidance from this document. Specifically, the kinds of nondietary exposures that were considered in this assessment include the following:

- Dose from eating granules calculated using SOP 2.3.1: Postapplication potential dose among small children from incidental nondietary ingestion of pesticide granules in the treated area (episodic exposure only).

- Dose from hand to mouth activity calculated using SOP 2.3.2: Postapplication potential dose among small children from incidental nondietary ingestion of pesticide residues on residential lawns from hand-to-mouth transfer.
- Dose from mouthing treated turf calculated using SOP 2.3.3: Postapplication potential dose among small children from the ingestion of pesticide treated turfgrass; and
- Dose from incidental ingestion of soil calculated using SOP 2.3.4: Postapplication potential dose among small children from the ingestion of soil in pesticide treated areas.

Incidental Granular Ingestion

This first formula illustrates the method of calculating granular ingestion by (SOP 2.3.1):

PDR = IgR x F x CF1

where:

PDR = potential dose rate (mg/day)
IgR = ingestion rate of granular formulation (g/day)
F = fraction of ai in dry formulation (unitless)
CF1 = weight unit conversion factor to convert grams to milligrams (1000 mg/g)

It is assumed in the SOP that a maximum of 0.3 gm/day dry pesticide will be ingested by small children. This is believed to be an upper-percentile estimate (similar to the teaspoonful described at the beginning of this section). The fraction of ai in granular formulations of thiophanate-methyl varies from 1 to 5 percent. No significant MBC exposure is anticipated from granular mouthing as granules are assumed (lacking specific data) to contain primarily thiophanate-methyl. Once granules have broken down to thiophanate-methyl and MBC foliar or soil residues, the exposure is considered using one of the following scenarios.

Hand to Mouth Transfer (Finger Licking)

The following demonstrates the method used to calculate exposures that are attributable to a child touching treated turf and then putting their hands in their mouth (SOP 2.3.2):

PDR = (AR * F-DR * CF * SA * EXT * Freq * Hr * (1 mg/1000 Fg)

where:

PDR	=	potential dose rate (mg/day)
AR	=	application rate (lb ai/A)
F-DR	=	fraction of residue dislodgeable from wet hands (5%)
CF	=	conversion factor to convert lb ai/A to Fg/cm^2 (11.2)
SA	=	surface area of 1 to 3 fingers (20 cm^2);
EXT	=	extraction rate by saliva (50%)
Freq	=	frequency of hand-to-mouth events (20 events/hour); and
Hr	=	exposure duration (2 hours)

The surface area for 1-3 fingers used (20 cm^2) is the median surface area for a small child (age 3 years) as updated by the SAP in 12/99. The frequency of hand-to-mouth events is 20 events per hour as updated in 12/99. The fraction of residue dislodgeable from wet hands is 5% and the extraction rate by saliva is 50% as updated by the SAP in 12/99. The time spent outdoors (2 hours/day) and the 2 hour duration value is also a recommended value from the U.S. EPA Exposure Factors Handbook. This model for hand-to-mouth dose is based on the premise that a child puts 2-3 fingers in their mouths, 5% of the residues on the hands are transferred from the hands to the mouth, 50% of the residues is extracted by saliva and that all of the residues available on the treated turf transfer to the child's hand each time they exhibit this behavior. However, MBC residues are very low compared to thiophanate-methyl, and initially increase and then decrease in the environment in a manner that is difficult to predict. Therefore, the ratio of MBC/thiophanate methyl residues was determined for the time period (DAT 0 in the PA TTR study) with highest quantifiable residues of MBC. The ratio was applied to the same updated SOP formulae for hand-to-mouth transfer and mouthing grass that were used to determine thiophanate-methyl incidental oral dose.

Mouthing Treated Turf

The following illustrates the approach used to calculate exposures that are attributable to a child mouthing treated turf (SOP 2.3.3):

PDR = (AR * F-DR * CF * IgR * (1 mg/1000Fg)

where:

PDR	=	potential dose rate (mg/day);
AR	=	application rate
F-DR	=	fraction of residue dislodgeable from wet hands (5%)
CF	=	conversion factor to convert lb ai/A to Fg/cm^2 (11.2)
IgR	=	ingestion rate for mouthing of grass per day (25 cm^2/day)

The ingestion rate used (25 cm^2/day) assumes that a child will grab a handful of turf, mouth it and remove all thiophanate-methyl and MBC residues, and then remove it from their mouth as described in the Residential SOPs. The surface area of (25 cm^2/day) is thought to approximate a handful of turf that is mouthed. Again, as with finger licking, the amount of MBC present is not easily related to the application rate of thiophanate-methyl, and MBC residues initially increase and then decrease in the environment in a manner that is difficult to predict. Therefore, the ratio of MBC to thiophanate-methyl residues was taken from the PA study data on DAT 0 (the highest residue) and applied to the applied to the SOP formula shown above.

Incidental Soil Ingestion

The following is the formula used to estimate exposure from incidental ingestion of soil treated with thiophanate-methyl:

$$PDR = (AP * (1-D)^t * IgR * CF1 * CF2 * CF3 * CF4)$$

where:

PDR	=	potential dose rate (mg/kg/day)
AP	=	application rate (lb ai/A)
(1-D)	=	fraction or residue retained on uppermost 1 cm of soil, assumed to be 100 percent based on soil incorporation into top 1 cm of soil after application (1.0/cm)
t	=	postapplication day on which exposure is being assessed, assumed to be day 0
IgR	=	ingestion rate of soil (100 mg/day)
CF1	=	weight unit conversion factor to convert the lbs ai in the application rate to Fg for the soil residue value (4.54×10^8 Fg/lb)
CF2	=	area unit conversion factor to convert the surface area units (ft^2) in the application rate to cm^2 for the SR value (2.47×10^{-8} acre/cm^2 if the application rate is per acre)
CF3	=	volume to weight unit conversion factor to convert the volume units (cm^3) to weight units for the SR value (0.67 cm^3/g soil)[7]
CF4	=	weight unit conversion factor to convert the Fg of residues on the soil to grams to provide units of mg/day (1E-6 g/Fg)

The estimated exposure from ingestion of soil from an area treated with pesticide is a minor contributor to the total incidental oral dose. For this reason, and the uncertainty in predicting the proportion of MBC/thiophanate-methyl or absolute MBC residues, exposure to MBC via this scenario was not evaluated.

Home Harvesting Fruit

For estimating post-application dermal exposure while harvesting home-grown fruit, the Residential SOP 4.2 was used and the foliar residue values were taken from the apple study (MRID 448763-01). Although the label currently states that the pesticide should be applied no sooner than the day before harvest, the SOP requires using the same day DFR value as residents do not have an enforceable restricted entry period. The duration of exposure is assumed to be 0.33 hours per day for youths and 0.67 hours per day for adults. Potential dose rates are calculated using the equation:

$$PDR = DFR * Tc * ET * CF1$$

where:

PDR	=	potential dose rate (mg/day)
DFR	=	dislodgeable foliar residue from apple leaves on DAT = 0
Tc	=	Transfer coefficient [5,000 cm^2/hr (youth); 10,000 cm^2/hr (adult)]
ET	=	Exposure time [0.33 hr (youth); 0.67 hr (adult)]

CF1 = weight unit conversion factor to convert the Fg of residues on the leaves to grams to provide units of mg/day (1E-6 g/Fg)

The following specific assumptions and factors were used in order to complete this exposure assessment:

- These assessments were based on the guidance provided in the Residential SOPs and updated based on the 1999 SAP comments. Several of the assumptions and factors used in the exposure assessment are described in that document.
- To assess short-term risks, the TTR and DFR values were used from day 0 in each study site; to assess intermediate-term risks, the TTR and DFR values were used from day 7 in each study site; for cancer, an average foliar residue value was used (i.e., a 14-day average if typically reapplied every 2 weeks and exposure is anticipated within that event window); since harvesting fruit is essentially a short-term intermittent activity, single day DFR values were used for cancer estimates;
- Calculations for short- and intermediate-term risks are based on the maximum application rate for each crop; calculations of cancer risks are based on the typical application rate for each crop, if known;
- Due to a lack of scenario-specific exposure data, HED has calculated exposure values for adults using surrogate dermal transfer coefficients that represent activities such as mowing, golfing, and yardwork.

The results of the residential post-application exposure and risk estimates are presented in Tables 17-20. The dermal risk estimates for adults and children exposed to *thiophanate-methyl* while doing activities on turf are shown in Tables 17a and 17b. The dermal risk estimates associated with adults and preteens exposed to *thiophanate-methyl* while harvesting treated fruit are contained in Tables 18a and 18b. The dermal risk estimates for adults and children exposed to *MBC* while doing activities on turf are shown in Table 19. The dermal risk estimates associated with adults and preteens exposed to *MBC* while harvesting treated fruit are contained in Table 20. The oral nondietary risk estimates for small children from hand-to-mouth and ingestion exposure while playing on thiophanate-methyl-treated turf are contained in Tables 21a (thiophanate-methyl exposure) and 21b (MBC exposure). Non-cancer risk estimates were aggregated where applicable for the *same* chemical but not aggregated for thiophanate-methyl and MBC in this assessment, due to differing toxicological endpoints. Cancer risk estimates were aggregated as summarized in Table 4.

Methods of Estimating Risks From Calculated Exposures

The exposures that were calculated in section 3.2.1 above represent the amount of thiophanate-methyl or MBC that can be deposited on the surface of the skin after application, or that can be attributed to the mouthing behaviors of children after contact with treated turf. The HED calculates dose levels using the following:

$$Daily\ Dose\left(\frac{mg\ ai}{kg/day}\right) = Daily\ Exposure\left(\frac{mg\ ai}{day}\right) x \left(\frac{AbsorptionFactor(\%/100)}{Body\ Weight\ (kg)}\right)$$

Where:

Daily Dose	=	the amount as potential dose (for the dermal calculations) or absorbed dose (for inhalation or nondietary ingestion calculations) received from exposure to a pesticide in a given scenario (mg pesticide active ingredient/kg body weight/day);
Daily Exposure	=	the amount of dermal (on the skin), inhalation (inhaled), or nondietary ingestion (from mouthing behaviors of children) exposure calculated above in section 4.a (mg pesticide active ingredient/day);
Absorption Factor	=	a measure of the flux or amount of chemical that crosses a biological boundary (% of the total available); and
Body Weight	=	body weight determined to represent the population of interest in a risk assessment (kg).

For thiophanate-methyl, a 70 kg median body weight for dermal exposures for all adults was used. For MBC, the average body weight for adults used in all residential exposure assessments is 60 kg which is inclusive of females 13-50 years old, since a developmental endpoint of concern is used for short- and intermediate-term oral and dermal exposures and inhalation exposure was not anticipated. The average body weight used in all assessments for youths 10-12 years old is 39 kg and for 3-year old children is 15 kg based on the SOPs For Residential Exposure Assessment. A 7% dermal absorption factor for thiophanate-methyl or 3.5% for MBC is applied to the oral NOAEL for dermal risk estimates. Absorption from inhalation and nondietary ingestion are 100 percent, the standard HED value used for these scenarios. For oral exposures for children, the oral NOAEL of 10 mg/kg/day for general population is used.

The NOAELs and the combined uncertainty factors that apply to all thiophanate-methyl/MBC risk estimates are listed in Section 1.3 above. The non-occupational target MOEs are 300 for thiophanate-methyl and 1000 for MBC. MOEs were calculated using the following formula:

$$MOE = \frac{NOAEL \left(\frac{mg}{kg/day} \right)}{Absorbed\ Daily\ Dose \left(\frac{mg}{kg/day} \right)}$$

Where:

MOE = margin of exposure or ratio of chemical exposure to the endpoint of concern;

Absorbed Daily Dose = the absorbed dose received from exposure to a pesticide in a given scenario (mg pesticide active ingredient/kg body weight/day); and

NOAEL = the highest dose level in a toxicity study where no observed adverse effects occur (mg pesticide active ingredient/kg body weight/day).

In order for the Agency to make more informed risk management decisions, MOEs can be added together in order to look at the aggregate exposures that occur for an individual if the toxic effect for each route of exposure (e.g., to the skin and being inhaled) is the same. For example, combining dermal and oral non-dietary ingestion MOEs for children is of interest because these exposures can occur at the same time. Additionally, combining exposures for residents who both mix/load and apply thiophanate-methyl for lawn care would be logical because it is likely that in most residences the same individual would be completing both of these tasks (mixing, loading, and applying were included in the estimate). The equation the HED uses to add MOEs together is presented below:

$$MOE_{total} = 1/((1/MOE_a) + (1/MOE_b) + ... (1/MOE_n))$$

Where: MOE_a, MOE_b, and MOE_n represent MOEs for each exposure route of concern

Thiophanate-methyl exposures for resident handlers (dermal and inhalation) were aggregated with the most likely postapplication exposure, which was dermal exposure during high-contact activities on the treated lawn. Children's dermal high-contact exposures to thiophanate-methyl on treated lawns were aggregated with hand to mouth exposure, as these events are likely to coincide. For MBC, the dermal and oral doses were combined for a single MOE, as they are based on a common toxic effect. However, the chemical-specific MOEs for thiophanate-methyl and MBC could not be combined as they are based on different toxic effects.

3.2.2 Postapplication Exposure and Non-Cancer Risk Estimates

Post-application dermal exposure and risk estimates are presented in Tables 17-20 and summarized in the following table.

Table 4
Potential Post-Application Exposures and Risks for Residential/Non-Occupational Uses of Thiophanate-methyl
(Short- and Intermediate-term)

Duration of Exposure (c)	Application Rate lb ai/A	Maximum Potential Dose (a) (mg/kg/day) / MOE (unitless) Target MOE$300 for TM and $1000 for MBC (e)						Cancer Risk Estimate (d)		
		Child 1-6 years (15 kg)		Adolescent 10-12 years (39 kg)		Adult (Includes females ≥ 13 years)				
		TM	MBC exposure (absorbed dose)	TM	MBC exposure (absorbed dose)	TM	MBC exposure (absorbed dose)	TM	MBC	Total TM and MBC
(1) Dermal Exposure During Treated Fruit Harvesting										
Short-Term	1.6 NC/1.3 C (based on peaches)	NA	NA	0.21 MOE= 470	0.026 (0.00091) MOE=11,000	**0.48 MOE= 210**	0.069 (0.0024) MOE=4,100	**3.7E-6**	4.6E-8	**3.7E-6**
Intermediate-term				0.056 MOE= 1,800		0.128 MOE= 780		1E-6	8.6E-8	**1.2E-6**
(2) Dermal Contact with Treated Turf										
Short-term	19.3 NC/5.4C	**1.2 MOE = 81**	0.049 (0.0017) MOE =5,800	Not calculated		**0.74 MOE = 140**	0.034 (0.0012) MOE=8,300	9.6E-7	6.7E-9	9.7E-7
	11 NC/5.4 C	**0.7 MOE=140**	0.028 (0.00098) MOE=10,000			**0.42 MOE= 240**	0.0197 (0.00069) MOE=15,000			
Intermediate-term	19.3 NC/5.4C	0.19 MOE=540	0.025 (0.00086) MOE=12,000			0.11 MOE = 890	0.017 (0.006) MOE=17,000			
	11 NC/5.4 C	0.106 MOE=940	0.0014 (0.000049) MOE=20,000			0.064 MOE= 1,600	0.01 (0.0035) MOE= 29,000			
(3) Dermal Contact During Mowing Treated Turf										
Short- to Intermediate-term	19.3 NC/5.4C	NA		0.046 MOE = 2,200	0.0018 (0.000064) MOE = 160,000	0.025 MOE = 3,900	0.0012 (0.000042) MOE = 240,000	1.9E-8	1.3E-10	1.9E-8
	11 NC/5.4 C			0.026 MOE= 3,800	0.001 (0.000036) MOE= 270,000	0.014 MOE= 6,900	0.000686 (0.000024) MOE= 420,000			
(4) Dermal Contact During Golfing or walking										
Short- to Intermediate-term	15 NC/5.4 C	NA		0.071 MOE =1,400	0.0028 (0.000098) MOE = 100,000	0.039 MOE =2,500	0.0018 (0.000063) MOE = 160,000	4.7E-8	3.3E-10	4.7E-8

Table 4
Potential Post-Application Exposures and Risks for Residential/Non-Occupational Uses of Thiophanate-methyl (Short- and Intermediate-term)

Duration of Exposure (c)	Application Rate lb ai/A	Maximum Potential Dose (a) (mg/kg/day) / MOE (unitless) Target MOE$300 for TM and $1000 for MBC (e)						Cancer Risk Estimate (d)		
		Child 1-6 years (15 kg)		Adolescent 10-12 years (39 kg)		Adult (Includes females ≥ 13 years)				
		TM	MBC exposure (absorbed dose)	TM	MBC exposure (absorbed dose)	TM	MBC exposure (absorbed dose)	TM	MBC	Total TM and MBC
	11 NC/5.4 C			0.052 MOE= 1,900	0.0021 (0.000074) MOE= 140,000	0.029 MOE= 3,500	0.0013 (0.000046) MOE= 210,000			
(5a) Turf Mouthing										
Short- and intermediate-term	19.3	**0.072 MOE=140**	0.00064 MOE= 15,000	NE		NE		NE		
	11	**0.041 MOE=240**								
(5b) Hand to Mouth										
Short- and intermediate-term	19.3	**0.29 MOE = 35**	**0.011 MOE = 910**	NE		NE		NE		
	11	**0.16 MOE=61**								
(5c) Granular Ingestion										
Short-term	11	**0.32 - 1.1 MOE = 9-31**	not calculated	NE		NE		NE		
(5d) Incidental Soil Ingestion										
Short- and intermediate-term	19.3	0.00097 MOE= 10,000	not calculated	NE		NE		NE		
	11	0.00055 MOE= 18,000								
Aggregate MOE (b)	19.3 Short-term	**21**	NA (different endpoints)							
	19.3 Intermediate-term	**27**								
	11 Short-term	**37**								
	11 Intermediate-term	**46**								

NA = Not applicable; NC=non cancer; C=cancer

NE = Not evaluated, because scenario not applicable to this population.

(a) Potential Dose not adjusted for absorption.

(b) Aggregate MOE for children 1-6 years includes dermal, turf mouthing, hand to mouth and incidental soil ingestion. There is a common endpoint of decreased body weight and food consumption for oral and dermal exposures.

(c) For thiophanate-methyl cancer risks for fruit harvesting, residues based on day after treatment (DAT 1) for short-term, DAT 7 for intermediate-term for fruit harvesting. MBC cancer risks for fruit harvesting based on maximum detected residues (on day 14 post treatment). For turf, cancer risks for thiophanate-methyl based on 14 day average residues, while cancer risks for MBC are based on the maximum residue.

(d) Cancer risks based on contact 14 days/year, 2 days/year and 5 days/year for 50 years for dermal lawn contact, mowing and golfing, respectively.

MOE_{dermal} = NOAEL / (Max Potential Dose * dermal/oral route conversion) . MBC oral NOAEL = 10 mg/kg/day, 3.5% dermal absorption. TM: dermal NOAEL = 100 mg/kg/day (no absorption necessary).

MOE_{oral} = oral NOAEL / (Max Potential Dose). MBC oral NOAEL = 10 mg/kg/day. TM oral NOAEL = 10 mg/kg/day

LADD = [Absorbed Dermal Dose * Exposure Days/Yr * 50 years] / [70 years lifetime * 365 days/year] * 60/70 oral/dermal endpoint body weight correction (for MBC only)

Cancer Risk = LADD * cancer Q_1, where Q1* = 0.00239 $(mg/kg/day)^{-1}$ for MBC and $1.38x10^{-2}$ (mg/kg/day)-1 for thiophanate-methyl.

Intermediate-term risk estimates for contact with lawns estimated using adjusted jazzercise-based Tc of 7300 cm2/hr for adult and 2600 cm2/hr for child per HED Revised Residential SOPs (02/01).

Thiophanate-methyl

Short-term non-cancer thiophanate-methyl risk estimates resulting from dermal contact with treated turf during high contact lawn activities exceeded the level of concern for adults (MOEs range from 140 to 260) and for children (MOEs range from 81 to 160). Intermediate-term non-cancer risks did not exceed the level of concern (ranging from 540 to 13,000) for adults or small children engaged in high contact activities using the data from either irrigated or non-irrigated sites. Short- and intermediate-term thiophanate-methyl risk estimates for youths 10-12 harvesting fruit, mowing or golfing did not exceed the level of concern (MOEs 11,000-270,000).

The risk calculations for small children's non-dietary ingestion of thiophanate-methyl on treated turf indicate that risks exceed the level of concern for hand-to-mouth transfer (MOE=35) , ingestion of granules (MOEs = 9 to 31) and incidental turfgrass mouthing (MOE=140 to 240). Incidental ingestion of soil did not exceed the level of concern (MOEs= 10,000 to 18,000). (Table 21a)

When risks from dermal exposures from thiophanate-methyl to small children are aggregated with risks from incidental oral exposures, the aggregated short-term risk estimates do not exceed the level of concern for all assessments (MOEs range from 21-37). The aggregated intermediate-term risks exceed the level of concern for all assessments, except when the dose from incidental ingestion of soil and high-contact dermal activities are combined, using the combined California/Georgia residue data.

MBC

Exposure risks were also estimated for these scenarios using the same protocols and the highest MBC residue levels from each corresponding study. The short-term risk estimates for contact with turf ranged from a low MOE of 5800 for a child playing on a lawn to a high MOE of 490,000 for an adult mowing a lawn for 2 hours (see Table 19). The short-term risk estimates for harvesting fruit range from a low MOE of 4100 for an adult harvesting peaches to 42,000 for a preteen harvesting pecans, strawberries, or pears. All adult, preteen, and small children risks had MOEs greater than the target MOE of 1000 (see Table 20). Small children's oral exposure estimates via turf mouthing (MOE 15,000) did not exceed the level of concern, but the hand-to-mouth (finger licking) MOE calculated by proportionate residues was 910 and exceeds the HED's level of concern (see Table 21b). The aggregated hand-to-mouth MBC risk estimate (MOE = 910) also exceed the level of concern.

3.2.3 Postapplication Cancer Risk Estimates

The HED endeavors to reduce estimated cancer risks for the general population to less than one in one million (10^{-6}). Estimated adult cancer risks were calculated using the same residential exposure scenarios as described in section 3.2.2.
The LADD must be calculated by first determining the dermal exposure from foliar contact:

$DE_{(t)}$ (mg/day) = ($TTR_{(t)}$ (Fg/cm^2) x TC (cm^2/hr) x Hr/Day)/1000 (Fg/mg)

Where:

DE	=	Dermal exposure at time (t) attributable for activity in a previously treated area (mg/day);
TTR	=	Turf Transferable Residue at time (t) where the longest duration (t) is dictated by the kinetics observed in the TTR study;
TC	=	Transfer Coefficient; and
Hr	=	Exposure duration in hours.

Then, the dermal exposure is converted to absorbed daily dose multiplied by the frequency of exposure in days per year:

LADD (mg/kg/day) =
DE/70 kg (mg/kg/day) * (days worked/365 days per year) * (50 years gardening/70 year lifetime)

and the cancer risk = LADD (mg/kg/day) * Q_1^* $(mg/kg/day)^{-1}$

Typical home/recreational lawn and ornamental applications, whether by resident or professional, were assumed to be once per year, based on the labels, the length of the season, market information, and characterization information received from registrants. Using an exposure frequency of five days per year, and 14 day average turf residues, the adult golfer cancer risk is estimated at 7.3 x 10^{-8}. An adult mowing a treated lawn twice during the 2 week postapplication period of residue dissipation, and exposed to 14 day average residues, has a cancer risk of 1.9 x 10^{-6}. Estimated cancer risks for adults from performing dermal high contact activities on turf range from 9.6 x 10^{-7} (PA data) to 3.1 x 10^{-7} (CA/GA data). An adult harvesting home orchards 40 minutes per day for 5 days per year for 50 years has a lifetime cancer risk of 1.1 x 10^{-6} to 3.7 x 10^{-6} at assumed average entry day 0, and of 1.3 x 10^{-6} to 4.5 x 10^{-7} at assumed average entry day 7.

Adult lifetime cancer risks were also estimated for MBC post-application residential exposure, using the maximum foliar residues from apple and turf studies, and all scenarios were below the target of 1 x 10^{-6}. The highest cancer risk estimate for MBC alone was 1.7 x 10^{-7} for adults performing high-contact activities on turf 14 days per year, while the lowest was 5.9 x 10^{-9} for playing golf.

3.2.4 Summary of Postapplication Risks, Data Gaps, and Confidence in Exposure and Risk Estimates

Potential residential exposures are anticipated as a result of resident application and professional lawn care operator application. The current labeling also permits application to "backyard orchards" and therefore home fruit harvesting represents another potential exposure. Risk estimates were performed for potential contact with lawn, soil, or trees treated with thiophanate-methyl, using studies submitted for apple DFR and turf transferable residues. These estimates should not be considered overly conservative, however, because the turf study data were adjusted for typical application rates and based on a study with two applications, whereas six or more applications on a 7-14 day interval are possible per information supplied by the registrants.

The target non-occupational MOE was 300 for thiophanate-methyl. The resulting surrogate residential postapplication assessment indicates that dermal contact after lawn is sprayed, or harvesting treated home fruit trees, at typical application rates would result in thiophanate-methyl MOEs of concern (i.e., below the target of 300). Aggregating, or adding residential handler exposure and postapplication exposure would lower the MOE even further. For example, aggregating the doses from granular application by push-spreader and high-contact work on treated turf (using the 11 lb ai/A rate, not maximum) provides a MOE of 200 for thiophanate-methyl exposure. Thiophanate-methyl cancer risk estimates were greater than 10^{-6} for high-contact activities on treated turf. Post-application home harvesting of fruit by adults did not have cancer risks of concern (all less than 10^{-6}). Most MBC risk estimates were below the level of concern using the maximum residues found. Only hand-mouth exposures to MBC had risk estimates which did not meet the target MOE of 1000.

The Residential SOPs are considered to be conservative scenarios for determining risk estimates. The adult and children's transfer coefficients are based on the Jazzercise protocol and an upper percentile exposure duration value. Where study data were used with the SOP formulae, these risk estimates were better refined, and hence, less conservative. Therefore the exposure estimates related to lawn and orchard skin contact (which were based on study data and had lower MOEs) are more refined than the estimates of incidental ingestion (which had higher MOEs).

3.3 RESIDENTIAL AND NON-OCCUPATIONAL RISK CHARACTERIZATION

3.3.1 Residential Handler Risk Characterization

The frequency of residential-user application of thiophanate-methyl to lawns is based in part on HED Exposure SAC policy, but also on a reasonable pattern of usage given label-recommended application frequency and an estimate of average "season" for fungal problems of 2-3 months. These assumptions mirror registrant estimates ranging from 1-6 applications per season. Further information on usage would be pertinent, particularly to estimating post-application exposures.

3.3.2 Non-Occupational Postapplication Risk Characterization

The median frequency of postapplication exposure to golf course turf is based on data provided by golfing associations. Therefore the risks associated with golfing are believed to be average, or not over-estimated. The short-term residential exposures to treated lawns or tree foliage were based upon exposure to transferable residues at the earliest possible opportunity and high rates of exposure. While this is a high-end scenario, it is not worst-case because the time of exposure is short, based on behavioral data, and the risk estimate is based on actual data supplied by the registrant, which did not use the highest number of applications for turf. The reentry intervals (1 and 7 days) for harvesting fruit on treated trees were selected to provide a range of risk estimates, as there are no information available to help predict when homeowners would pick their fruit.

Mitigating circumstances for residential exposure to thiophanate-methyl residues may include the watering-in of both liquid and granular formulations turf. There is some evidence from the study data submitted that watering or rainfall increases the residue dissipation rate (see summaries of Turf TTR study; also Apple study). Turf labels variously call for watering or irrigation within 24 hours or less. This instruction, however, does not prevent contact with treated turf prior to watering-in.

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Appendix
Thiophanate-methyl Exposure and Risk Estimates
Tables 5-23

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
Mixer/Loader												
(1a) Mixing/ Loading Wettable Powder for Aerial/ Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	14	3.0e-05	3.0e-04	100	1.8e-06	1.8e-05	Not necessary	9.2e-08	9.2e-07
	pecans, strawberries, pears	0.7NC/0.6 C		7.0	5.1e-05	5.1e-04	110	3.0e-06	3.0e-05		1.6e-07	1.6e-06
	wheat, soybeans	0.7	1200	2.0	2.1e-04	2.1e-03	39	1.2e-05	1.2e-04	680	6.3e-07	6.3e-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	4.8	8.6e-05	8.6e-04	93	5.0e-06	5.0e-05	1,600	2.6e-07	2.6e-06
	almonds, beans	1.4 NC/1C		3.5	8.6e-05	8.6e-04	66	5.0e-06	5.0e-05	1,200	2.6e-07	2.6e-06
	peaches	1.6 NC/1.3C		3.0	1.1e-04	1.1e-03	58	6.5e-06	6.5e-05	1,000	3.4e-07	3.4e-06
	onions, sod farms	15 NC/11 C		0.3	9.4e-04	9.4e-03	6.2	5.5e-05	5.5e-04	110	2.9e-06	2.9e-05
	ornamentals (foliar spray) aerial	0.7 NC/0.5C	80	30.0	NA	7.8e-05	210	NA	4.6e-06	Not necessary	NA	2.4e-07
	ornamentals (foliar spray) chemigation	2.8 NC/2.1C	80	8	4.1e-05	NA	120	2.4e-06	NA		1.3e-07	NA
	ornamentals (soil directed drench) chemigation	77NC/37C	5	4.4	4.5e-05	1.4e-04	84	2.7e-06	8.5e-06	1,500	1.4e-07	4.3e-07
(1b) Mixing/ Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	61	6.9e-06	6.9e-05	420	4e-07	4e-06	Not necessary	Not Necessary	2.1e-07
	strawberries	0.7 NC/0.6 C		30	1.2e-05	1.2e-04	210	6.9e-07	6.9e-06			3.6e-07
	wheat, soybeans	0.7	200	12	3.4e-05	3.4e-04	200	2.0e-06	2.0e-05		1.1e-07	1.1e-06
	grapes, potatoes	1	80	21	2.0e-05	2.0e-04	150	1.1e-06	1.1e-05		6.0e-08	6.0e-07
	beans	1.4 NC/1C		15	2.0e-05	2.0e-04	100	1.1e-06	1.1e-05		6.0e-08	6.0e-07
	onions, sod farms	15 NC/11C		1.4	2.2e-04	2.2e-03	27	1.3e-05	1.3e-04	480	6.6e-07	6.6e-06
	golf course turf	15 NC/11 C	40	2.8	1.1e-04	3.2e-04	54	6.3e-06	1.9e-05	960	3.3e-07	9.9e-07
	ornamentals (foliar spray)	2.8NC/2.1C	80	7.6	2.1e-05	6.2e-05	120	1.2e-06	3.6e-06	Not necessary	6.3e-08	1.9e-07
	ornamentals (soil drench)	77NC/37C	5	4.4	4.5e-05	1.4e-04	84	2.7e-06	8.5e-05	1,500	1.4e-07	4.3e-07
(1c) Mixing/ Loading Wettable Powder for Airblast Application	pecans, pears	0.7 NC/0.6C	40	61	5.9e-06	5.9e-05	420	3.4e-07	3.4e-06	Not necessary		1.8e-07
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1		42	9.8e-06	9.8e-05	290	5.7e-07	5.7e-06			3.0e-07
	almonds	1.4 NC/1C		30	9.8e-06	9.8e-05	210	5.7e-07	5.7e-06	Not necessary		3.0e-07

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
	peaches	1.6 NC/1.3C		26	1.3e-05	1.3e-04	200	7.5e-07	7.5e-06			3.9e-07
	ornamentals	2.8 NC/2.1C	20	30	1.0e-05	1.0e-04	210	6.0e-07	6.0e-06			3.2e-07
(1d)Mixing/ Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.8 NC/2.1C	100	6.1	5.1e-05	5.1e-04	120	3.0e-06	3.0e-05	Not necessary	1.6e-07	1.6e-06
	ornamental (soil drench)	77NC/37C	1	22	9.1e-06	9.1e-05	150	5.3e-07	5.3e-06		2.8e-08	2.8e-07
	turf	15 NC/5.4 C	100	1.1	1.4e-04	1.4e-03	22	7.7e-06	7.7e-05	380	4.1e-07	4.1e-06
(1e) Mixing/ Loading Wettable Powder for Dip Application	bulbs	0.012 lb ai/gal	100 gallons	1,400	2.9e-07	2.9e-06	Not necessary		1.7e-07	Not necessary		
	cuttings	0.007 lb ai/gal	100 gallons	2,400	1.7e-07	5.1e-07			3.0e-08			
(2a) Mixing/ Loading Dry Flowable /WDG for Aerial/ Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	780	5.3e-07	5.3e-06			3.4e-06	Not necessary		9.2e-07
	pecans, strawberries	0.7 NC/0.6 C		390	9.2e-07	9.2e-06			5.9e-06			1.6e-06
	wheat, soybeans	0.7	1200	110	3.7e-06	3.7e-05	110	2.3e-06	2.3e-05	Not necessary	6.3e-07	6.3e-06
	apples, apricots, cherries, nectarines, plums/prunes	1	350	270	1.5e-06	1.5e-05	Not necessary	9.8e-07	9.8e-06		Not necessary	2.6e-06
	almonds, beans	1.4 NC/1C		190	1.5e-06	1.5e-05		9.8e-07	9.8e-06	Not necessary	2.6e-07	2.6e-06
	peaches	1.6 NC/1.3C		170	2.0e-06	2.0e-05		1.3e-06	1.3e-05		3.4e-07	3.4e-06
	onions, sod farms	15 NC/11 C		18	1.7e-05	1.7e-04	27	1.1e-05	1.1e-04	110	2.9e-06	2.9e-05
	ornamentals (foliar spray) aerial	0.7 NC/0.5 C	80	1,700	NA	1.4e-06	Not necessary	NA	8.9e-07	Not necessary	NA	Not necessary
	ornamentals (foliar spray) chemigation	2.8 NC/2.1 C	80	420	7.3e-07	NA	Not necessary		NA	Not necessary		NA
	ornamentals (soil directed drench) chemigation	37	5	510	8.1e-07	2.4e-06			1.5e-06			4.2e-07
(2b) Mixing/ Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	3,400	1.2e-07	1.2e-06			7.8e-07			Not necessary
	strawberries	0.7 NC/0.6C		1,700	2.1e-07	2.1e-06			1.3e-06			3.6e-07
	wheat, soybeans	0.7	200	680	6.1e-07	6.1e-06			3.9e-06			1.1e-06
	beans	1.4 NC/1 C	80	850	3.5e-07	3.5e-06			2.2e-06			6.0e-07
	onions, sod farms	15 NC/11 C		79	3.8e-06	3.8e-05	110	2.5e-06	2.5e-05	Not necessary	6.6e-07	6.6e-06
	golf course turf	15 NC/11 C	40	160	1.9e-06	5.8e-06	Not necessary	1.2e-06	3.7e-06		3.3e-07	9.9e-07
	ornamentals (foliar spray)	2.8 NC/2.1C	80	420	7.3e-07	2.2e-06	Not necessary		1.4e-06	Not necessary		3.8e-07
	ornamentals (soil drench)	37	5	510	8.1e-07	2.4e-06			1.5e-06			4.2e-07

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
(2c) Mixing/ Loading Dry Flowable/WDG for Airblast Application	pecans	0.7 NC/0.6C	40	3,400	1.0e-07	1.0e-06	Not necessary		6.7e-07	Not necessary		Not necessary
	apples, apricots, cherries, plums/prunes, nectarines	1		2,400	1.7e-07	1.7e-06			1.1e-06			3.0e-07
	almonds	1.4 NC/1 C		1,700	1.7e-07	1.7e-06			1.1e-06			3.0e-07
	peaches	1.6 NC/1.3C		1,500	2.3e-07	2.3e-06			1.4e-06			3.9e-07
	ornamentals	2.8 NC/2.1C	20	1,700	1.8e-07	1.8e-06			1.2e-06			3.2e-07
(2d) Mixing/ Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.8 NC/2.1C	100	340	9.2e-07	9.2e-06	Not necessary		5.9e-06			1.6e-06
	ornamental (soil drench)	37	1	2,600	1.6e-07	1.6e-06			1.0e-06			Not necessary
	turf	15 NC/5.4C	100	63	2.4e-06	2.4e-05	96	1.6e-06	1.6e-05	380	4.2e-07	4.2e-06
(2e) Mixing/ Loading Dry Flowable/WDG for Dip Application	bulbs	0.012 lb ai/gal	100 gallons	79,000	5.2e-09	5.2e-08	Not necessary			Not necessary		Not necessary
	cuttings	0.007 lb ai/gal		140,000	3.1e-09	9.2e-09						
(3a) Mixing/ Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	20	2.0e-05	2.0e-04	1,600	1.4e-07	1.4e-06			6.8e-07
	pecans, strawberries, pears	0.7 NC/0.6C		9.8	3.5e-05	3.5e-04	820	2.4e-07	2.4e-06			1.2e-06
	wheat, soybeans	0.7	1200	2.9	1.4e-04	1.4e-03	240	9.7e-07	9.7e-06			4.7e-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	6.9	5.8e-05	5.8e-04	570	4.1e-07	4.1e-06	Not necessary		1.9e-06
	almonds, beans	1.4 NC/1 C		4.9	5.8e-05	5.8e-04	410	4.1e-07	4.1e-06			1.9e-06
	peaches	1.6 NC/1.3C		4.3	7.5e-05	7.5e-04	360	5.3e-07	5.3e-06			2.5e-06
	sod farms	15 NC/11 C		0.5	6.4e-04	6.4e-03	69	4.5e-06	4.5e-05	140	2.1e-06	2.1e-05
	ornamentals (foliar spray) aerial	0.7 NC/0.5C	80	43	NA	5.3e-05	3,600	NA	3.7e-07	NN	NA	NN
	ornamentals (foliar spray) chemigation	2.8 NC/2.1C	80	11	2.8e-05	NA	890	1.9e-07	NA	Not necessary		NA
	ornamentals (soil directed drench) chemigation	37	5	13	3.1e-05	9.2e-05	1,100	2.1e-07	6.4e-07			Not necessary
(3b) Mixing/ Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	86	4.6e-06	4.6e-05	7,100	3.2e-08	3.2e-07			
	strawberries	0.7 NC/0.6C		43	7.9e-06	7.9e-05	3,600	5.6e-08	5.6e-07			
	wheat, soybeans	0.7	200	17	2.3e-05	2.3e-04	1,400	1.6e-07	1.6e-06			7.8e-07
	grapes	1	80	30	1.3e-05	1.3e-04	2,500	9.3e-08	9.3e-07			Not necessary

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
	beans	1.4 NC/1C		21	1.3e-05	1.3e-04	1,800	9.3e-08	9.3e-07			
	sod farms	15 NC/11C		2.0	1.5e-04	1.5e-03	170	1e-06	1e-05	Not necessary	4.9e-07	4.9e-06
	golf course turf	15NC/11 C	40	4.0	7.3e-05	2.2e-04	330	5.1e-07	1.5e-06	Not necessary		7.3e-07
	ornamentals (foliar spray)	2.8 NC/2.1C	80	11.0	2.8e-05	8.3e-05	890	1.9e-07	5.8e-07			Not necessary
	ornamentals (soil drench)	77NC/37C	5	6.2	3.1e-05	9.2e-05	520	2.1e-07	6.4e-07			3.1E-07
(3c) Mixing/ Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.7 NC/0.6C	40	86	4.0e-06	4.0e-05	7,100	2.8e-08	2.8e-07	Not necessary		
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1		60	6.6e-06	6.6e-05	5,000	4.6e-08	4.6e-07			
	almonds	1.4 NC/1 C		43	6.6e-06	6.6e-05	3,600	4.6e-08	4.6e-07			
	peaches	1.6 NC/1.3C		38	8.6e-06	8.6e-05	3,300	6e-08	6e-07			
	ornamentals	2.8 NC/2.1C	20	43	6.9e-06	6.9e-05	3,600	4.9e-08	4.9e-07			
(3d) Mixing/ Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.8NC/2.1 C	100	8.6	3.5e-05	3.5e-04	710	2.4e-07	2.4e-06	Not necessary		1.2e-06
	ornamental (soil drench)	77NC/37C	1	31	6.1e-06	6.1e-05	2,600	4.3e-08	4.3e-07			Not necessary
	turf	15NC/5.4C	100	1.6	8.9e-05	8.9e-04	130	6.3e-07	6.3e-06	Not necessary		3e-06
(3e) Mixing/ Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012 lb ai/gal	100 gallons	2,000	2.0e-07	2.0e-06	Not necessary		1.4e-08	Not necessary		
	cuttings	0.007 lb ai/gal		3,400	1.2e-07	3.5e-07	Not necessary					
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	130	NA	3.2e-05	140	NA	8.1e-06	Not necessary	NA	6.4e-07
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	130	4.0e-06	4.0e-05	Not necessary	1e-06	1e-05	Not necessary	8.0e-08	8.0e-07
	turf	11	40	630	8.2e-07	2.4e-06	Not necessary		6.2e-07	Not necessary		
		5.4		1,300	4.0e-07	1.2e-06			3e-07			
	sod farms	11	80	310	1.6e-06	1.6e-05	Not necessary	4.1e-07	4.1e-06	Not necessary	3.3e-08	3.3e-07
		5.4		640	8.0e-07	8.0e-06	Not necessary		2.0e-06	Not necessary		1.6e-07
(5) Loading Dusts (Fenske et al., 1991(k) and Stevens and Davis, 1980 (l)	peanut seeds (gloves)	0.047	20 (l)	See PPE			7,600	6.5e-08	2.2e-07	No Data		
	potato seed pieces (gloves)	1.2 (l)	30 (l)				200	2.5e-06	8.3e-06			
Applicator												

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	See Eng. Controls						10,000	Not applicable	4.1e-07
	pecans, strawberries, pears	0.7NC/0.6C								5,000		7.1e-07
	wheat, soybeans	0.7	1200							1,500		2.8e-06
	apples, apricots, cherries, nectarines, plums/ prunes, grapes	1	350							3,500		1.2e-06
	almonds, beans	1.4NC/1 C								2,500		1.2e-06
	peaches	1.6NC/1.3C								2,200		1.5e-06
	onions, sod farms	15NC/11C								230		1.3e-05
	ornamentals (foliar spray) aerial	0.7NC/0.5C	80							22,000		1.1e-07
(7) Applying Granulars Aerially	ornamentals	27	80							250	NA	2.5E-5
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	12,000	3.9e-08	3.9e-07	Not necessary					
	strawberries	0.7NC/0.6C		5,800	6.7e-08	6.7e-07						
	wheat, soybeans	0.7	200	2,300	2.0e-07	2.0e-06	Not necessary		1.0e-06	Not necessary		4.5e-07
	grapes, potatoes	1	80	4,100	1.1e-07	1.1e-06			6.0e-07			Not necessary
	beans	1.4NC/1C		2,900	1.1e-07	1.1e-06			6.0e-07			
	onions, sod farms	15NC/11C		270	1.2e-06	1.2e-05	Not necessary	6.6e-07	6.6e-06			2.8e-06
	golf course turf	15NC/11C	40	550	6.1e-07	6.1e-06	Not necessary		3.3e-06			1.4e-06
	ornamentals (foliar spray)	2.8NC/2.1C	80	1,500	2.3e-07	7.0e-07			Not necessary			Not necessary
	ornamentals (soil drench)	77	5	850	5.4e-07	1.6e-06			8.6e-07			
		37		1,800	2.6e-07	7.7e-07	Not necessary					
(9) Applying with an Airblast Sprayer	pecans, pears	0.7NC/0.6C	40	620	5.8e-07	5.8e-06	Not necessary		3.2e-06	Not necessary		3.5e-07
	apples, apricots, cherries,plums/prunes, nectarines, grapes	1		430	9.6e-07	9.6e-06			5.3e-06			5.8e-07
	almonds	1.4NC/1C		310	9.6e-07	9.6e-06	Not necessary		5.3e-06	Not necessary		5.8e-07
	peaches	1.6NC/1.3C		270	1.3e-06	1.3e-05	Not necessary	7.0e-07	6.9e-06	Not necessary	7.5e-08	7.5e-07
	ornamentals	2.8NC/2.1C	20	310	1.0e-06	1.0e-05	Not necessary		5.5e-06	Not necessary		6.1e-07
(10) Applying with a Handgun Sprayer	ornamentals (foliar spray)	2.8NC/2.1C	5	530	5.6e-07	5.6e-06			2.1e-06	Not feasible		

Table 5
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Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
	ornamentals (soil drench)	77	0.05	2,000	2.1e-07	2.1e-06			7.7e-07			
		37		4,000	9.9e-08	9.9e-07			3.7e-07			
	turf	15NC/5.4C	5	99	1.5e-06	1.5e-05	140	5.4e-07	5.4e-06			
(11) Applying Granular Formulations with a Tractor-Drawn Spreader	ornamentals	27	40	300	1.7e-06	1.7e-05	Not necessary	4.7e-07	4.7e-06	Not necessary	3.2e-07	3.2e-06
	turf	11		730	6.7e-07	6.7e-06	Not necessary		1.9e-06	Not necessary		1.3e-06
		5.4		1,500	3.3e-07	3.3e-06			9.3e-07			Not necessary
(12) Applying Dip Treatment	bulbs	0.012 lb ai/gal	100 gallons	No Data								
	cuttings	0.007 lb ai/gal										
(13) Applying Dust as a Potato Seed Treatment (Stevens and Davis, 1981)	cutting/sorting (gloves)	1.2 (l)	30 (l)	No Data - See PPE			2,700	1.6e-07	5.4e-07	Not feasible/not necessary		
	planter/operator (enclosed cab)			See Eng. Controls						3,600	1.3e-07	4.5e-07
	planter/observer (no gloves)			4,400	1.1e-07	3.6e-07	Not necessary			No Data/Not necessary		
Mixer/Loader/Applicator												
(14) Mixing/ Loading/Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007 lb ai/gal	1000 gallons	See PPE			270	7.7e-07	2.3e-06	Not feasible		
(15) Mixing/ Loading/Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007 lb ai/gal	40 gallons	See PPE			1,300	2.5e-07	1.5e-06			
	turf (j)	15NC/5.4C	0.5				110	2.4e-06	1.4e-05			
(16) Mixing/ Loading/Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007 lb ai/gal	40 gallons	250	2.7e-06	1.6e-05	Not necessary	1.2e-08	7.2e-08			
	turf (j)	15NC/5.4C	0.5	9.3	2.6e-05	1.5e-04	1,300	1.2e-07	7e-07			
(17) Mixing/ Loading/Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007 lb ai/gal	40 gallons	No Data						Not feasible		
	turf (j)	15NC/11C	0.5									

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
(18) Mixing/ Loading/Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007 lb ai/gal	40 gallons	See PPE			8,900	5.1e-08	3.1e-07	Not feasible		
	turf(j)	15NC/5.4C	0.5				330	5e-07	3e-06			
(19a) Mixing/ Loading/Applying Liquid Formulations with a Handgun Sprayer (ORETF data, MRID 44972201)	ornamental (foliar spray)	2.8NC/2.1C	5	710	4.3e-07	4.3e-06	Not necessary		1.5e-06	Not feasible		
	ornamental (soil drench)	77NC/37C	0.05	2,600	7.5e-08	7.5e-07			2.7e-07			
	turf	15NC/5.4C	5	130	1.1e-06	1.1e-05	Not necessary	3.9e-07	3.9e-06			
(19b) Mixing/ Loading/ Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data, MRID 44972201)	ornamental (foliar spray)	2.8NC/2.1C	5	480	5.1e-07	5.1e-06	Not necessary		1.7e-06	Not feasible		
	ornamental (soil drench)	37NC/37C	0.05	3,600	8.9e-08	8.9e-07			3.0e-07			
	turf	15NC/5.4C	5	90	1.3e-06	1.3e-05	120	4.4e-07	4.4e-06			
(19c) Mixing/ Loading/ Applying Wettable Powders with a Handgun Sprayer (ORETF data, MRID 44972201)	ornamental (foliar spray)	2.8NC/2.1C	5	310	1.1e-06	1.1e-05	Not necessary	3.3e-07	3.3e-06	Not feasible		
	ornamental (soil drench)	77NC/37C	0.05	1,100	2.0e-07	2.0e-06	Not necessary		5.8e-07			
	turf	15NC/5.4C	5	58	2.9e-06	2.9e-05	110	8.5e-07	8.5e-06			
(20) Loading/ Applying Granules to Turf using Belly Grinder	ornamentals	27	1	24	1.7e-05	1.7e-04	45	9.0e-06	9.0e-05	Not feasible		
	turf	11		60	6.8e-06	6.8e-05	100	3.7e-06	3.7e-05			
		5.4		120	3.3e-06	3.3e-05	Not necessary	1.8e-06	1.8e-05			
(21) Loading/ Applying Granules to Turf using Push-Type Spreader (ORETF data, MRID 44972201)	ornamentals	27	5	120	3.5e-06	3.5e-05	180	1.1e-06	1.1e-05	Not Feasible		
	turf	11		300	1.4e-06	1.4e-05	Not necessary	4.4e-07	4.4e-06			
		5.4		610	7.0e-07	7.0e-06	Not necessary		2.2e-06			
(22) Loading/ Applying Dust as a Seed Treatment (dry) in Planter Box (k)(Fenske et al., 1990)	peanuts	0.047	20	No Data			710	5.6e-07	5.6e-06	No Data		

Table 5
Thiophanate-methyl: Summary of Occupational Handler Short- and Intermediate-Term Exposure and Cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Maximum Application Rate (lb ai/acre or lb ai/gallon) (a)	Amount Treated Per Day (Acres or Gallons) (b)	Baseline Risks (c)			PPE Mitigation Risks (d)			Engineering Control Risks (e)		
				Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk(i)		Combined Dermal and Inhalation MOE (f)	Cancer Risk (i)	
					Private (g)	Commercial (h)		Private (g)	Commercial (h)		Private (g)	Commercial (h)
(23) Mixing/ Loading/Applying a Dip Treatment	bulbs	0.012 lb ai/gal	100 gallons	No Data								
	cuttings	0.007 lb ai/gal										
Flagger												
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	3,900	1.1e-07	1.1e-06	Not necessary		7.6e-07	Not necessary		3.9e-07
	pecans, pears, strawberries,	0.7NC/0.6C	350	2,000	1.9e-07	1.9e-06			1.3e-06			6.7e-07
	wheat, soybeans	0.7	350	2,000	2.2e-07	2.2e-06			1.5e-06			7.8e-07
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	1,400	3.2e-07	3.2e-06			2.2e-06			1.1e-06
	almonds, beans	1.4NC/1C		990	3.2e-07	3.2e-06			2.2e-06			1.1e-06
	peaches	1.6NC/1.3C		860	4.1e-07	4.1e-06			2.8e-06			1.4e-06
	onions, sod farms	15NC/11C		92	3.5e-06	3.5e-05	120	2.4e-06	2.4e-05	250	1.2e-06	1.2e-05
	ornamentals (foliar spray)	2.8NC/2.1C	80	2,200	1.5e-07	1.2e-06	Not necessary		8.4e–07	Not necessary		Not necessary
(25) Flagging Aerial Granular Applications	ornamentals	27	80	750	6.1e-07	4.8e-06			2e-06			5.1e-06

NA=Not applicable; NC= non-cancer; C= cancer, NN=not necessary

(a) Application rates are the maximum application rates determined from EPA registered labels. Typical application rate (used in the cancer risk estimates) were determined from EPA registered labels when a range of application rates was specified. Maximum application rate was used as a surrogate for typical rate when a range was not specified.
NC= non-cancer; C= cancer

(b) Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available. Ornamental acres treated aerially is based on personal communication with ANLA on 12/7/00.

(c) Baseline clothing assumes long pants, long sleeved shirt, no gloves, open mixing/loading, open cab/tractor for applications, and no respirator or dust mask.

(d) PPE added to achieve target MOE of 100. Assumes gloves and no respirator for most cases, and in some cases assumes double layer clothing. See Tables 7a-7b for inputs and calculations.

(e) Engineering Controls include: Water-Soluble Packets or Enclosed Cab Aircraft

(f) Short/Intermediate-term dermal MOE = NOAEL (100 mg/kg/day / daily dermal dose (mg/kg/day). Short/Intermediate-term inhalation MOE = NOAEL (10 mg/kg/day / daily inhalation dose (mg/kg/day). Where daily dermal dose = dermal/inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (60 kg female >13 yrs).
Short/Intermediate-term total MOE = 1 / 1/dermal MOE) + (1/inhalation MOE).

(g) Majority of private applicator treatments per year is 3, which is based on labeled number of treatments to an individual site (e.g., farm, nursery, golf course) and represents number of days per year of expected exposure. BEAD and other use data were used in determining treatment day estimates (e.g., facility or farm size / acres per day in footnote b = exposure days / year).

(h) Most commercial applicator treatments per year is 30, which is based on treatment of multiple sites or farms and represents number of days per year of expected exposure.

(i) Cancer Risk = Total LADD (mg/kg/day) x Q_1*. Where Q_1* is 0.0138 mg/kg/day^{-1}; where total LADD (mg/kg/day) = ADD (mg/kg/day) x treatment days per year (for private or commercial as appropriate) / 365 days/year x 35 years worked / 70 year lifetime; and where ADD (mg/kg/day) = absorbed daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day) where absorbed daily dermal dose = dermal unit exposure (mg/lb ai) x typical application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) x dermal absorption factor (7%) / body weight (70 kg adult), and inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).

(j) For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.

(k) Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

(l) Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate-methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Cancer risk was based on 3-10 planting days per year , assuming USDA estimates of farm size (i.e., 100-300 acres depending on geographic region). Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
Mixer/Loader											
(1a) Mixing/Loading Wettable Powder for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3.7	0.043	6.5	0.08	15	130	14
	pecans, strawberries, pears	0.7	350	acres	3.7	0.043	13.0	0.15	7.7	66	6.9
	wheat, soybeans	0.7	1200	acres	3.7	0.043	44	0.52	2.3	19	2.0
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3.7	0.043	19	0.22	5.4	47	4.8
	almonds, beans	1.4	350	acres	3.7	0.043	26	0.30	3.9	33	3.5
	peaches	1.6	350	acres	3.7	0.043	30	0.34	3.4	29	3.0
	onions, sod farms	15	350	acres	3.7	0.043	278	3.23	0.4	3.1	0.3
	ornamentals (foliar spray) aerial	0.7	80	acres	3.7	0.043	3.0	0.03	34	290	30
	ornamentals (foliar spray) chemigation	2.8	80	acres	3.7	0.043	12	0.14	8	73	8
	ornamentals (soil directed drench) chemigation	77	5	acres	3.7	0.043	20	0.24	5	42	4.4
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3.7	0.043	1.5	0.017	68	580	61
	strawberries	0.7	80	acres	3.7	0.043	3.0	0.034	34	290	30
	wheat, soybeans	0.7	200	acres	3.7	0.043	7.4	0.086	14	120	12
	grapes, potatoes	1	80	acres	3.7	0.043	4.2	0.049	24	200	21
	beans	1.4	80	acres	3.7	0.043	5.9	0.069	17	150	15
	onions, sod farms	15	80	acres	3.7	0.043	63	0.74	1.6	14	1.4
	golf course turf	15	40	acres	3.7	0.043	32	0.37	3.2	27	2.8
	ornamentals (foliar spray)	2.8	80	acres	3.7	0.043	12	0.14	8.4	73	7.6
	ornamentals (soil drench)	77	5	acres	3.7	0.043	20	0.24	4.9	42	4.4
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.7	40	acres	3.7	0.043	1.5	0.017	68	580	61
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3.7	0.043	2.1	0.025	47	410	42

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
	almonds	1.4	40	acres	3.7	0.043	3.0	0.034	34	290	30
	peaches	1.6	40	acres	3.7	0.043	3.4	0.039	30	250	26
	ornamentals	2.8	20	acres	3.7	0.043	3.0	0.034	34	290	30
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	3.7	0.043	15	0.17	7	58	6.1
	ornamental (soil drench) (i)	77	1	acres	3.7	0.043	4.1	0.047	25	210	22
	turf (j)	15	100	acres	3.7	0.043	79	0.92	1.3	11.0	1.1
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gallons	3.7	0.043	0.063	7.4E-04	1,600	14,000	1,400
	cuttings	0.007	100	gallons	3.7	0.043	0.037	4.3E-04	2,700	23,000	2,400
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	0.066	7.7E-04	0.12	1.3E-03	870	7,400	780
	pecans, strawberries	0.7	350	acres	0.066	7.7E-04	0.23	2.7E-03	430	3,700	390
	wheat, soybeans	0.7	1200	acres	0.066	7.7E-04	0.79	9.2E-03	130	1,100	110
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	0.066	7.7E-04	0.33	3.9E-03	300	2,600	270
	almonds, beans	1.4	350	acres	0.066	7.7E-04	0.46	5.4E-03	220	1,900	190
	peaches	1.6	350	acres	0.066	7.7E-04	0.53	6.2E-03	190	1,600	170
	onions, sod farms	15	350	acres	0.066	7.7E-04	4.95	5.8E-02	20	170	18
	ornamentals (foliar spray) aerial	0.7	80	acres	0.066	7.7E-04	0.053	6.2E-04	1,900	16,000	1,700
	ornamentals (foliar spray) chemigation	2.8	80	acres	0.066	7.7E-04	0.21	2.5E-03	470	4,100	420
	ornamentals (soil directed drench) chemigation	37	5	acres	0.066	7.7E-04	0.17	2.0E-03	570	4,900	510
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	0.066	7.7E-04	0.026	3.1E-04	3,800	32,000	3,400
	strawberries	0.7	80	acres	0.066	7.7E-04	0.053	6.2E-04	1,900	16,000	1,700
	wheat, soybeans	0.7	200	acres	0.066	7.7E-04	0.13	1.5E-03	760	6,500	680
	beans	1.4	80	acres	0.066	7.7E-04	0.11	1.2E-03	950	8,100	850
	onions, sod farms	15	80	acres	0.066	7.7E-04	1.13	0.013	88	760	79
	golf course turf	15	40	acres	0.066	7.7E-04	0.57	6.6E-03	180	1,500	160

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
	ornamentals (foliar spray)	2.8	80	acres	0.066	7.7E-04	0.21	2.5E-03	470	4,100	420
	ornamentals (soil drench)	37	5	acres	0.066	7.7E-04	0.17	2.0E-03	570	4,900	510
(2c) Mixing/Loading Dry Flowable/WDG for Airblast Application	pecans	0.7	40	acres	0.066	7.7E-04	0.026	3.1E-04	3,800	32,000	3,400
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	0.066	7.7E-04	0.038	4.4E-04	2,700	23,000	2,400
	almonds	1.4	40	acres	0.066	7.7E-04	0.053	6.2E-04	1,900	16,000	1,700
	peaches	1.6	40	acres	0.066	7.7E-04	0.060	7.0E-04	1,700	14,000	1,500
	ornamentals	2.8	20	acres	0.066	7.7E-04	0.053	6.2E-04	1,900	16,000	1,700
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	0.066	7.7E-04	0.264	3.1E-03	380	3,200	340
	ornamental (soil drench) (i)	37	1	acres	0.066	7.7E-04	0.035	4.1E-04	2,900	25,000	2,600
	turf	15	100	acres	0.066	7.7E-04	1.41	0.017	71	610	63
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gallons	0.066	7.7E-04	1.1E-03	1.3E-05	88,000	7.6E+05	7.9E+04
	cuttings	0.007	100	gallons	0.066	7.7E-04	6.6E-04	7.7E-06	150,000	1.3E+06	1.4E+05
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	2.9	1.2E-03	5.1	2.1E-03	20	4,800	20
	pecans, strawberries, pears	0.7	350	acres	2.9	1.2E-03	10	4.2E-03	9.9	2,400	9.8
	wheat, soybeans	0.7	1200	acres	2.9	1.2E-03	35	1.4E-02	2.9	690	2.9
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	2.9	1.2E-03	15	6.0E-03	6.9	1,700	6.9
	almonds, beans	1.4	350	acres	2.9	1.2E-03	20	8.4E-03	4.9	1,200	4.9
	peaches	1.6	350	acres	2.9	1.2E-03	23	9.6E-03	4.3	1,000	4.3
	sod farms	15	350	acres	2.9	1.2E-03	218	0.090	0.5	110	0.5
	ornamentals (foliar spray) aerial	0.7	80	acres	2.9	1.2E-03	2.3	9.6E-04	43	10000	43
	ornamentals (foliar spray) chemigation	2.8	80	acres	2.9	1.2E-03	9.3	3.8E-03	11	2,600	11
	ornamentals (soil directed drench) chemigation	37	5	acres	2.9	1.2E-03	7.7	3.2E-03	13	3,200	13

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	2.9	1.2E-03	1.2	4.8E-04	86	21,000	86
	strawberries	0.7	80	acres	2.9	1.2E-03	2.3	9.6E-04	43	10,000	43
	wheat, soybeans	0.7	200	acres	2.9	1.2E-03	5.8	2.4E-03	17	4,200	17
	grapes	1	80	acres	2.9	1.2E-03	3.3	1.4E-03	30	7,300	30
	beans	1.4	80	acres	2.9	1.2E-03	4.6	1.9E-03	22	5,200	21
	sod farms	15	80	acres	2.9	1.2E-03	50	0.021	2.0	490	2.0
	golf course turf	15	40	acres	2.9	1.2E-03	25	0.010	4.0	970	4.0
	ornamentals (foliar spray)	2.8	80	acres	2.9	1.2E-03	9.3	3.8E-03	11.0	2,600	11.0
	ornamentals (soil drench) (i)	77	5	acres	2.9	1.2E-03	16	6.6E-03	6.3	1,500	6.2
(3c) Mixing/Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.7	40	acres	2.9	1.2E-03	1.2	4.8E-04	86	21,000	86
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	2.9	1.2E-03	1.7	6.9E-04	60	15,000	60
	almonds	1.4	40	acres	2.9	1.2E-03	2.3	9.6E-04	43	10,000	43
	peaches	1.6	40	acres	2.9	1.2E-03	2.7	1.1E-03	38	9,100	38
	ornamentals	2.8	20	acres	2.9	1.2E-03	2.3	9.6E-04	43	10,000	43
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	2.9	1.2E-03	12	4.8E-03	8.6	2,100	8.6
	ornamental (soil drench) (i)	77	1	acres	2.9	1.2E-03	3.2	1.3E-03	31	7,600	31
	turf (j)	15	100	acres	2.9	1.2E-03	62	2.6E-02	1.6	390	1.6
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gallons	2.9	1.2E-03	0.050	2.1E-05	2,000	4.9E+05	2,000
	cuttings	0.007	100	gallons	2.9	1.2E-03	0.029	1.2E-05	3,400	8.3E+05	3,400
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	0.0084	1.7E-03	0.26	5.2E-02	390	190	130
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	0.0084	1.7E-03	0.26	5.2E-02	390	190	130
	turf	11	40	acres	0.0084	1.7E-03	0.053	1.1E-02	1,900	940	630
		5.4	40	acres	0.0084	1.7E-03	0.026	5.2E-03	3,900	1,900	1,300
	sod farms	11	80	acres	0.0084	1.7E-03	0.106	2.1E-02	950	470	310

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
		5.4	80	acres	0.0084	1.7E-03	0.052	1.0E-02	1,900	950	640
(5) Loading Dusts (Exposure studies used for Unit Exposure values) (k)	peanut seeds	0.047	20	acres	No Data	0.056	No Data	7.5E-04	No Data	13,000	No Data
	potato seed pieces	1.2	30	acres	No Data	0.056	No Data	2.9E-02	No Data	350	NA
Applicator											
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	acres	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
	pecans, strawberries, pears	0.7	350	acres							
	wheat, soybeans	0.7	1200	acres							
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres							
	almonds, beans	1.4	350	acres							
	peaches	1.6	350	acres							
	onions, sod farms	15	350	acres							
	ornamentals (foliar spray) aerial	0.7	80	acres							
(7) Applying Granulars Aerially	ornamentals	27	80	acres	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	0.014	7.4E-04	5.6E-03	3.0E-04	18,000	34,000	12,000
	strawberries	0.7	80	acres	0.014	7.4E-04	0.011	5.9E-04	8,900	17,000	5,800
	wheat, soybeans	0.7	200	acres	0.014	7.4E-04	0.028	1.5E-03	3,600	6,800	2,300
	grapes, potatoes	1	80	acres	0.014	7.4E-04	0.016	8.5E-04	6,300	12,000	4,100
	beans	1.4	80	acres	0.014	7.4E-04	0.022	1.2E-03	4,500	8,400	2,900
	onions, sod farms	15	80	acres	0.014	7.4E-04	0.24	0.013	420	790	270
	golf course turf	15	40	acres	0.014	7.4E-04	0.12	6.3E-03	830	1,600	550
	ornamentals (foliar spray)	2.8	80	acres	0.014	7.4E-04	0.045	2.4E-03	2,200	4,200	1,500
	ornamentals (soil drench)	77	5	acres	0.014	7.4E-04	0.077	4.1E-03	1,300	2,500	850

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
		37	5	acres	0.014	7.4E-04	0.037	2.0E-03	2,700	5,100	1,800
(9) Applying with an Airblast Sprayer	pecans, pears	0.7	40	acres	0.36	4.5E-03	0.14	1.8E-03	690	5,600	620
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	0.36	4.5E-03	0.21	2.6E-03	490	3,900	430
	almonds	1.4	40	acres	0.36	4.5E-03	0.29	3.6E-03	350	2,800	310
	peaches	1.6	40	acres	0.36	4.5E-03	0.33	4.1E-03	300	2,400	270
	ornamentals	2.8	20	acres	0.36	4.5E-03	0.29	3.6E-03	350	2,800	310
(10) Applying with a Handgun Sprayer (ORETF Data)	ornamentals (foliar spray)	2.8	5	acres	0.93	1.0E-03	0.19	2.0E-04	540	50,000	530
	ornamentals (soil drench) (l)	77	0.05	acres	0.93	1.0E-03	0.05	5.5E-05	2000	180,000	2000
		37	0.05	acres	0.93	1.0E-03	0.02	2.6E-05	4100	380,000	4000
	turf	15	5	acres	0.93	1.0E-03	1.0	1.1E-03	100	9,300	99
(11) Applying Granular Formulations with a Tractor-Drawn Spreader	ornamentals	27	40	acres	9.9E-03	1.2E-03	0.15	0.019	650	540	300
	turf	11	40	acres	9.9E-03	1.2E-03	0.062	7.5E-03	1,600	1,300	730
		5.4	40	acres	9.9E-03	1.2E-03	0.031	3.7E-03	3,300	2,700	1,500
(12) Applying Dip Treatment	bulbs	0.012	100	gallons	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons							
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (k)	cutting/sorting	1.2	30	acres	No Data - See PPE	0.0029	No Data - See PPE	1.5E-03	No Data - See PPE	6,700	No Data - See PPE
	planter/operator	1.2	30	acres	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
	planter observer	1.2	30	acres	0.024	0.002	0.0123	1.0E-03	8,100	9,700	4,400
Mixer/Loader/Applicator											
(14) Mixing/Loading/Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007	1000	gallons	See PPE	0.12	See PPE	0.012	See PPE	830	NA - See PPE

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
(15) Mixing/Loading/Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	See PPE	1.1	See PPE	4.4E-03	See PPE	2,300	NA - See PPE
	turf	15	0.5	acres	See PPE	1.1	See PPE	0.12	See PPE	85	NA - See PPE
(16) Mixing/Loading/Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	100	0.03	0.40	1.2E-04	250	83,000	250
	turf	15	0.5	acres	100	0.03	11	3.2E-03	9.3	3,100	9.3
(17) Mixing/Loading/Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	No Data						
	turf	15	0.5	acres							
(18) Mixing/loading/Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007	40	gallons	See PPE	0.03	See PPE	1.2E-04	See PPE	83,000	NA - See PPE
	turf (n)	15	0.5	acres	See PPE	0.03	See PPE	3.2E-03	See PPE	3,100	NA - See PPE
(19a) Mixing/Loading/Applying Liquid Formulations with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.69	1.9E-03	0.14	3.8E-04	720	26,000	710
	ornamental (soil drench) (l)	77	0.05	acres	0.69	1.9E-03	0.038	1.0E-04	2,600	96,000	2,600
	turf	15	5	acres	0.69	1.9E-03	0.74	2.0E-03	140	4,900	130
(19b) Mixing/Loading/Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.82	0.022	0.16	4.4E-03	610	2,300	480
	ornamental (soil drench) (l)	37	0.05	acres	0.82	0.022	0.022	5.8E-04	4,600	17,000	3,600
	turf	15	5	acres	0.82	0.022	0.88	0.024	110	420	90
(19c) Mixing/Loading/Applying Wettable Powders with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.99	0.062	0.20	0.012	510	810	310
	ornamental (soil drench) (l)	77	0.05	acres	0.99	0.062	0.054	3.4E-03	1,800	2,900	1,100
	turf	15	5	acres	0.99	0.062	1.06	0.066	94	150	58

Table 6a: Thiophanate-methyl: Occupational Handler Baseline Short- to Intermediate-term Non-cancer Risk Estimates

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon)(a)	Acreage or other Daily Unit (b)	Units	Baseline Dermal Unit Exposure (mg/lb ai)(c)	Baseline Inhalation Unit Exposure (mg/lb ai)(d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (e)	Dermal MOE (f)	Inhalation MOE (g)	Total MOE (h)
(20) Loading/Applying Granules using Belly Grinder	ornamentals	27	1	acres	10	0.062	3.86	0.024	26	420	24
	turf	11	1	acres	10	0.062	1.57	9.7E-03	64	1,000	60
		5.4	1	acres	10	0.062	0.77	4.8E-03	130	2,100	120
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data)	ornamentals	27	5	acres	0.35	0.0075	0.68	0.014	150	690	120
	lawns, golf courses	11	5	acres	0.35	0.0075	0.28	0.006	360	1,700	300
		5.4	5	acres	0.35	0.0075	0.14	2.9E-03	740	3,500	610
(22) Loading/Applying Dust as a Seed Treatment (dry) in planter box (Fenske et al., 1990 used for unit exposure value) (m)	peanuts	0.047	20	acres	No Data	0.0024	No Data	3.2E-05	No Data	310,000	No Data
(23) Mixing/Loading/Applying a Dip Treatment	bulbs	0.012	100	gallons	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons							
Flagger											
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	0.011	3.5E-04	0.019	6.1E-04	5,200	16,000	3,900
	pecans, pears, strawberries	0.7	350	acres	0.011	3.5E-04	0.039	1.2E-03	2,600	8,200	2,000
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	0.011	3.5E-04	0.055	1.8E-03	1,800	5,700	1,400
	almonds, beans	1.4	350	acres	0.011	3.5E-04	0.077	2.5E-03	1,300	4,100	990
	peaches	1.6	350	acres	0.011	3.5E-04	0.088	2.8E-03	1,100	3,600	860
	onions, sod farms	15	350	acres	0.011	3.5E-04	0.825	0.0263	120	380	92
	ornamentals (foliar spray)	2.8	80	acres	0.011	3.5E-04	0.035	1.1E-03	2,800	8,900	2,200
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	0.0028	1.5E-04	0.086	4.6E-03	1,200	2,200	750

Footnotes:

a Application rates are the maximum application rates determined from EPA registered labels, except where specific turf and ornamental rates supplied by registrant are also shown.

b Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available. Ornamental acres treated aerially is based on person communication with ANLA on 12/7/00. Lawn and ornamental rates are explained in footnotes i-l below.

c Unless otherwise footnoted dermal unit exposure values from PHED Surrogate Exposure Guide, draft version August, 1998. Baseline dermal exposure assumes long pants, long sleeved shirt, no gloves, open mixing/loading, open cab/tractor.

d Unless otherwise footnoted, inhalation unit exposure values from PHED Surrogate Exposure Guide, draft version August, 1998. Baseline inhalation exposure assessed as a no respirator scenario .
e Daily dermal dose = dermal unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).
f Short/Intermediate-term dermal MOE = NOAEL (100 mg/kg/day / daily dermal dose (mg/kg/day). Where
g Short/Intermediate-term inhalation MOE = NOAEL (10 mg/kg/day / daily inhalation dose (mg/kg/day). Where daily inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).
h Short/Intermediate-term total MOE = 1 / 1/dermal MOE) + (1/inhalation MOE).
i Represents support of 20 LCO trucks holding 500 gallons of solution each. These 20 trucks could apply 10,000 gallons of TM solution to 1 acre for a drench treatment.
j Represents support of 20 LCO trucks which can treat 5 acres each.
k Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.
l Represents 1 truck holding 500 gallons of TM solution which could treat 0.05 acres (1/20th of an acre which receives 10,000 gallons/acre) as a drench treatment.
m Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.
n For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.
ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)
NA = not applicable

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
Mixer/Loader										
(1a) Mixing/Loading Wettable Powder for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	2.2E-03	2.2E-02	3.0E-05	3.0E-04
	pecans, strawberries, pears	0.6	350	acres	3	30	3.7E-03	3.7E-02	5.1E-05	5.1E-04
	wheat, soybeans	0.7	1200	acres	3	30	1.5E-02	1.5E-01	2.1E-04	2.1E-03
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	6.2E-03	6.2E-02	8.6E-05	8.6E-04
	almonds, beans	1	350	acres	3	30	6.2E-03	6.2E-02	8.6E-05	8.6E-04
	peaches	1.3	350	acres	3	30	8.1E-03	8.1E-02	1.1E-04	1.1E-03
	onions, sod farms	11	350	acres	3	30	6.8E-02	6.8E-01	9.4E-04	9.4E-03
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	5.7E-03	NA	7.8E-05
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	3.0E-03	NA	4.1E-05	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	3.3E-03	9.8E-03	4.5E-05	1.4E-04
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	5.0E-04	5.0E-03	6.9E-06	6.9E-05
	strawberries	0.6	80	acres	3	30	8.5E-04	8.5E-03	1.2E-05	1.2E-04
	wheat, soybeans	0.7	200	acres	3	30	2.5E-03	2.5E-02	3.4E-05	3.4E-04
	grapes, potatoes	1	80	acres	3	30	1.4E-03	1.4E-02	2.0E-05	2.0E-04
	beans	1	80	acres	3	30	1.4E-03	1.4E-02	2.0E-05	2.0E-04
	onions, sod farms	11	80	acres	3	30	1.6E-02	1.6E-01	2.2E-04	2.2E-03
	golf course turf	11	40	acres	3	9	7.8E-03	2.3E-02	1.1E-04	3.2E-04
	ornamentals (foliar spray)	2.1	40	acres	3	9	1.5E-03	4.5E-03	2.1E-05	6.2E-05
	ornamentals (soil drench)	37	5	acres	3	9	3.3E-03	9.8E-03	4.5E-05	1.4E-04

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.6	40	acres	3	30	4.3E-04	4.3E-03	5.9E-06	5.9E-05
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	7.1E-04	7.1E-03	9.8E-06	9.8E-05
	almonds	1	40	acres	3	30	7.1E-04	7.1E-03	9.8E-06	9.8E-05
	peaches	1.3	40	acres	3	30	9.2E-04	9.2E-03	1.3E-05	1.3E-04
	ornamentals	2.1	20	acres	3	30	7.4E-04	7.4E-03	1.0E-05	1.0E-04
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	3.7E-03	3.7E-02	5.1E-05	5.1E-04
	ornamental (soil drench)	37	1	acres	3	30	6.6E-04	6.6E-03	9.1E-06	9.1E-05
	turf	5.4	100	acres	3	30	9.6E-03	9.6E-02	1.3E-04	1.3E-03
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gallons	3	30	2.1E-05	2.1E-04	2.9E-07	2.9E-06
	cuttings	0.007	100	gallons	3	9	1.2E-05	3.7E-05	1.7E-07	5.1E-07
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	3.9E-05	3.9E-04	5.3E-07	5.3E-06
	pecans, strawberries	0.6	350	acres	3	30	6.6E-05	6.6E-04	9.2E-07	9.2E-06
	wheat, soybeans	0.7	1200	acres	3	30	2.7E-04	2.7E-03	3.7E-06	3.7E-05
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	3	30	1.1E-04	1.1E-03	1.5E-06	1.5E-05
	almonds, beans	1	350	acres	3	30	1.1E-04	1.1E-03	1.5E-06	1.5E-05
	peaches	1.3	350	acres	3	30	1.4E-04	1.4E-03	2.0E-06	2.0E-05
	onions, sod farms	11	350	acres	3	30	1.2E-03	1.2E-02	1.7E-05	1.7E-04
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	1.0E-04	NA	1.4E-06
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	5.3E-05	NA	7.3E-07	NA

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	5.9E-05	1.8E-04	8.1E-07	2.4E-06
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	8.9E-06	8.9E-05	1.2E-07	1.2E-06
	strawberries	0.6	80	acres	3	30	1.5E-05	1.5E-04	2.1E-07	2.1E-06
	wheat, soybeans	0.7	200	acres	3	30	4.4E-05	4.4E-04	6.1E-07	6.1E-06
	beans	1	80	acres	3	30	2.5E-05	2.5E-04	3.5E-07	3.5E-06
	onions, sod farms	11	80	acres	3	30	2.8E-04	2.8E-03	3.8E-06	3.8E-05
	golf course turf	11	40	acres	3	9	1.4E-04	4.2E-04	1.9E-06	5.8E-06
	ornamentals (foliar spray)	2.1	80	acres	3	9	5.3E-05	1.6E-04	7.3E-07	2.2E-06
	ornamentals (soil drench)	37	5	acres	3	9	5.9E-05	1.8E-04	8.1E-07	2.4E-06
(2c) Mixing/Loading Dry Flowable/WDG for Airblast Application	pecans	0.6	40	acres	3	30	7.6E-06	7.6E-05	1.0E-07	1.0E-06
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	3	30	1.3E-05	1.3E-04	1.7E-07	1.7E-06
	almonds	1	40	acres	3	30	1.3E-05	1.3E-04	1.7E-07	1.7E-06
	peaches	1.3	40	acres	3	30	1.6E-05	1.6E-04	2.3E-07	2.3E-06
	ornamentals	2.1	20	acres	3	30	1.3E-05	1.3E-04	1.8E-07	1.8E-06
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	6.6E-05	6.6E-04	9.2E-07	9.2E-06
	ornamental (soil drench)	37	1	acres	3	30	1.2E-05	1.2E-04	1.6E-07	1.6E-06
	lawns	5.4	100	acres	3	30	1.7E-04	1.7E-03	2.4E-06	2.4E-05
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gallons	3	30	3.8E-07	3.8E-06	5.2E-09	5.2E-08
	cuttings	0.007	100	gallons	3	9	2.2E-07	6.6E-07	3.1E-09	9.2E-09

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	1.5E-03	1.5E-02	2.0E-05	2.0E-04
	pecans, strawberries, pears	0.6	350	acres	3	30	2.5E-03	2.5E-02	3.5E-05	3.5E-04
	wheat, soybeans	0.7	1200	acres	3	30	1.0E-02	1.0E-01	1.4E-04	1.4E-03
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	3	30	4.2E-03	4.2E-02	5.8E-05	5.8E-04
	almonds, beans	1	350	acres	3	30	4.2E-03	4.2E-02	5.8E-05	5.8E-04
	peaches	1.3	350	acres	3	30	5.5E-03	5.5E-02	7.5E-05	7.5E-04
	sod farms	11	350	acres	3	30	4.6E-02	4.6E-01	6.4E-04	6.4E-03
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	3.8E-03	NA	5.3E-05
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	2.0E-03	NA	2.8E-05	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	2.2E-03	6.7E-03	3.1E-05	9.2E-05
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	3.4E-04	3.4E-03	4.6E-06	4.6E-05
	strawberries	0.6	80	acres	3	30	5.8E-04	5.8E-03	7.9E-06	7.9E-05
	wheat, soybeans	0.7	200	acres	3	30	1.7E-03	1.7E-02	2.3E-05	2.3E-04
	grapes	1	80	acres	3	30	9.6E-04	9.6E-03	1.3E-05	1.3E-04
	beans	1	80	acres	3	30	9.6E-04	9.6E-03	1.3E-05	1.3E-04
	sod farms	11	80	acres	3	30	1.1E-02	1.1E-01	1.5E-04	1.5E-03
	golf course turf	11	40	acres	3	9	5.3E-03	1.6E-02	7.3E-05	2.2E-04
	ornamentals (foliar spray)	2.1	80	acres	3	9	2.0E-03	6.0E-03	2.8E-05	8.3E-05
	ornamentals (soil drench)	37	5	acres	3	9	2.2E-03	6.7E-03	3.1E-05	9.2E-05

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(3c) Mixing/Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.6	40	acres	3	30	2.9E-04	2.9E-03	4.0E-06	4.0E-05
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	4.8E-04	4.8E-03	6.6E-06	6.6E-05
	almonds	1	40	acres	3	30	4.8E-04	4.8E-03	6.6E-06	6.6E-05
	peaches	1.3	40	acres	3	30	6.2E-04	6.2E-03	8.6E-06	8.6E-05
	ornamentals	2.1	20	acres	3	30	5.0E-04	5.0E-03	6.9E-06	6.9E-05
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	2.5E-03	2.5E-02	3.5E-05	3.5E-04
	ornamental (soil drench)	37	1	acres	3	30	4.4E-04	4.4E-03	6.1E-06	6.1E-05
	turf	5.4	100	acres	3	30	6.5E-03	6.5E-02	8.9E-05	8.9E-04
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gallons	3	30	1.4E-05	1.4E-04	2.0E-07	2.0E-06
	cuttings	0.007	100	gallons	3	9	8.4E-06	2.5E-05	1.2E-07	3.5E-07
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	NA	24	NA	2.3E-03	NA	3.2E-05
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	3	30	2.9E-04	2.9E-03	4.0E-06	4.0E-05
	turf	11	40	acres	3	9	5.9E-05	1.8E-04	8.2E-07	2.4E-06
		5.4	40	acres	3	9	2.9E-05	8.7E-05	4.0E-07	1.2E-06
	sod farms	11	80	acres	3	30	1.2E-04	1.2E-03	1.6E-06	1.6E-05
		5.4	80	acres	3	30	5.8E-05	5.8E-04	8.0E-07	8.0E-06

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(5) Loading Dusts (Exposure studies used for Unit Exposure values) (g)	peanut seeds	0.047	20	acres	3	10	NA	NA	NA	NA
	potato seed pieces	1.2	30	acres	3	10	NA	NA	NA	NA
Applicator										
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	acres	NA	30	See Engineering Controls (Closed Cockpit)			
	pecans, strawberries, pears	0.6	350	acres	NA	30				
	wheat, soybeans	0.7	1200	acres	NA	30				
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	NA	30				
	almonds, beans	1	350	acres	NA	30				
	peaches	1.3	350	acres	NA	30				
	onions, sod farms	11	350	acres	NA	30				
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24				
(7) Applying Granulars Aerially	ornamentals	27	80	acres	NA	30				
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	2.8E-06	2.8E-05	3.9E-08	3.9E-07
	strawberries	0.6	80	acres	3	30	4.8E-06	4.8E-05	6.7E-08	6.7E-07
	wheat, soybeans	0.7	200	acres	3	30	1.4E-05	1.4E-04	2.0E-07	2.0E-06
	grapes, potatoes	1	80	acres	3	30	8.1E-06	8.1E-05	1.1E-07	1.1E-06
	beans	1	80	acres	3	30	8.1E-06	8.1E-05	1.1E-07	1.1E-06
	onions, sod farms	11	80	acres	3	30	8.9E-05	8.9E-04	1.2E-06	1.2E-05
	golf course turf	11	40	acres	3	30	4.4E-05	4.4E-04	6.1E-07	6.1E-06
	ornamentals (foliar spray)	2.1	80	acres	3	9	1.7E-05	5.1E-05	2.3E-07	7.0E-07

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
	ornamentals (soil drench)	37	5	acres	3	9	1.9E-05	5.6E-05	2.6E-07	7.7E-07
(9) Applying with an Airblast Sprayer	pecans, pears	0.6	40	acres	3	30	4.2E-05	4.2E-04	5.8E-07	5.8E-06
	apples, apricots, cherries, plums/prunes, nectarines, grapes, potatoes	1	40	acres	3	30	7.0E-05	7.0E-04	9.6E-07	9.6E-06
	almonds	1	40	acres	3	30	7.0E-05	7.0E-04	9.6E-07	9.6E-06
	peaches	1.3	40	acres	3	30	9.1E-05	9.1E-04	1.3E-06	1.3E-05
	ornamentals	2.1	20	acres	3	30	7.3E-05	7.3E-04	1.0E-06	1.0E-05
(10) Applying with a Handgun Sprayer (ORETF Data)	ornamentals (foliar spray)	2.1	5	acres	3	30	4.1E-05	4.1E-04	5.6E-07	5.6E-06
	ornamentals (soil drench)	37	0.05	acres	3	30	7.2E-06	7.2E-05	9.9E-08	9.9E-07
	turf	5.4	5	acres	3	30	1.1E-04	1.1E-03	1.5E-06	1.5E-05
(11) Applying Granulars with Tractor-Drawn Spreader	ornamentals	27	40	acres	3	30	1.2E-04	1.2E-03	1.7E-06	1.7E-05
	turf	5.4	40	acres	3	30	2.4E-05	2.4E-04	3.3E-07	3.3E-06
(12) Applying Dip Treatment	bulbs	0.012	100	gallons	3	30	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons	3	9				
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (g)	cutting/sorting	1.2	30	acres	3	10	No Data - See PPE	No Data - See PPE	No Data - See PPE	No Data - See PPE
	planter/operator	1.2	30	acres	3	10	No Data - See Engineering Controls	No Data - See Engineering Controls	See Eng Con	See Eng Con
	planter/observer	1.2	30	acres	3	10	7.8E-06	2.6E-05	1.1E-07	3.6E-07
Mixer/Loader/Applicator										

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(14) Mixing/Loading/Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007	1000	gallons	3	9	NA - See PPE			
(15) Mixing/Loading/Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	NA - See PPE			
	turf (i)	5.4	0.5	acres	5	30	NA - See PPE			
(16) Mixing/Loading/Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	1.9E-04	1.2E-03	2.7E-06	1.6E-05
	turf (i)	5.4	0.5	acres	5	30	1.9E-03	1.1E-02	2.6E-05	1.5E-04
(17) Mixing/Loading/Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	No Data	No Data	No Data	No Data
	turf (i)	5.4	0.5	acres	5	30				
(18) Mixing/loading/Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	see PPE	see PPE	see PPE	see PPE
	turf (i)	5.4	0.5	acres	5	30				
(19a) Mixing/Loading/Applying Liquids with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	3.1E-05	3.1E-04	4.3E-07	4.3E-06
	ornamental (soil drench)	37	0.05	acres	3	30	5.5E-06	5.5E-05	7.5E-08	7.5E-07
	turf	5.4	5	acres	3	30	8.0E-05	8.0E-04	1.1E-06	1.1E-05

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(19b) Mixing/Loading/Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	3.7E-05	3.7E-04	5.1E-07	5.1E-06
	ornamental (soil drench)	37	0.05	acres	3	30	6.5E-06	6.5E-05	8.9E-08	8.9E-07
	turf	5.4	5	acres	3	30	9.4E-05	9.4E-04	1.3E-06	1.3E-05
(19c) Mixing/Loading/Applying Wettable Powder Formulations with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	8.1E-05	8.1E-04	1.1E-06	1.1E-05
	ornamental (soil drench)	37	0.05	acres	3	30	1.4E-05	1.4E-04	2.0E-07	2.0E-06
	turf	5.4	5	acres	3	30	2.1E-04	2.1E-03	2.9E-06	2.9E-05
(20) Loading/Applying Granules to Turf using Belly Grinder	ornamentals	27	1	acres	3	30	1.2E-03	1.2E-02	1.7E-05	1.7E-04
	turf	11	1	acres	3	30	4.9E-04	4.9E-03	6.8E-06	6.8E-05
		5.4	1	acres	3	30	2.4E-04	2.4E-03	3.3E-06	3.3E-05
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data)	ornamentals	27	5	acres	3	30	2.5E-04	2.5E-03	3.5E-06	3.5E-05
	turf including golf courses	11	5	acres	3	30	1.0E-04	1.0E-03	1.4E-06	1.4E-05
		5.4	5	acres	3	30	5.1E-05	5.1E-04	7.0E-07	7.0E-06

Table 6b: Thiophanate Methyl: Baseline Occupational Handler Cancer Risk Estimates										
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial ApplicatorTreatments / Yr (d)	Private Applicator Total LADD (mg/kg/day) (e)	Commercial Applicator Total LADD (mg/kg/day) (e)	Private Applicator Cancer Risk (f)	Commercial Applicator Cancer Risk (f)
(22) Mixing/Loading/Applying Dust as a Seed Treatment (dry) in planter box (Fenske et al., 1990 used for unit exposure value) (h)	peanuts	0.047	20	acres	3	30	No Data	No Data	No Data	No Data
(23) Mixing/Loading/Applying a Dip Treatment	bulbs	0.012	100	gallons	3	30	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons	3	9	No Data	No Data	No Data	No Data
Flagger										
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	8.1E-06	8.1E-05	1.1E-07	1.1E-06
	pecans, pears, strawberries	0.6	350	acres	3	30	1.4E-05	1.4E-04	1.9E-07	1.9E-06
	wheat, soybeans	0.7	350	acres	3	30	1.6E-05	1.6E-04	2.2E-07	2.2E-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	2.3E-05	2.3E-04	3.2E-07	3.2E-06
	almonds, beans	1	350	acres	3	30	2.3E-05	2.3E-04	3.2E-07	3.2E-06
	peaches	1.3	350	acres	3	30	3.0E-05	3.0E-04	4.1E-07	4.1E-06
	onions, sod farms	11	350	acres	3	30	2.5E-04	2.5E-03	3.5E-06	3.5E-05
	ornamentals (foliar spray)	2.1	80	acres	3	24	1.1E-05	8.8E-05	1.5E-07	1.2E-06
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	3	24	4.4E-05	3.5E-04	6.1E-07	4.8E-06

Footnotes:

a Application rates used were "typical rates" where available from BEAD surveys or information provided by the registrants. Where such information was not available, maximum application rates were determined from EPA registered labels.

b Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available.

Ornamental acres treated aerially is based on person communication with ANLA on 12/7/00.

c Private applicator treatments per year are based on treatments to an individual site (e.g., farm, nursery, golf course) and represents number of days per year of expected exposure. Best professional judgment and BEAD data were used in determining treatment day estimates (e.g., facility or farm size / acres per day in footnote b = exposure days / year).

d Commercial applicator treatments per year are based on treatment of multiple sites or farms and represents number of days per year of expected exposure.

e Total LADD (mg/kg/day) = ADD (mg/kg/day) x treatment days per year (for private or commercial as appropriate) / 365 days/year x 35 years worked / 70 year lifetime;
ADD (mg/kg/day) = absorbed daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day) where absorbed daily dermal dose = dermal unit exposure (mg/lb ai) x typical application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) x dermal absorption factor (7%) / body weight (70 kg adult), and inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70).

f Cancer Risk = Total LADD (mg/kg/day) x Q_1*. Where Q_1* is 0.0138 mg/kg/day^{-1}.

g Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Cancer risk was based on 3-10 planting days per year , assuming USDA estimates of farm size (i.e., 100-300 acres depending on geographic region). Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

h qUnit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

i For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.

ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)

NA = not applicable

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
Mixer/Loader																	
(1a) Mixing/ Loading Wettable Powder for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	0.17	0.13	8.6E-03	0.30	0.23	0.015	340	440	660	95	100	220	260
	pecans, strawberries	0.7	350	acres	0.17	0.13	8.6E-03	0.60	0.46	0.030	170	220	330	48	51	110	130
	wheat, soybeans	0.7	1200	acres	0.17	0.13	8.6E-03	2.0	1.6	0.10	49	64	97	14	15	33	39
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	0.17	0.13	8.6E-03	0.85	0.65	0.043	120	150	230	33	36	78	93
	almonds, beans	1.4	350	acres	0.17	0.13	8.6E-03	1.2	0.91	0.060	84	110	170	24	26	56	66
	peaches	1.6	350	acres	0.17	0.13	8.6E-03	1.4	1.04	0.069	74	96	150	21	22	49	58
	onions, sod farms	15	350	acres	0.17	0.13	8.6E-03	13	9.75	0.645	8	10	16	2.2	2.4	5.2	6.2
	ornamentals (foliar spray) aerial	0.7	80	acres	0.17	0.13	8.6E-03	0.14	0.10	6.9E-03	740	960	1,500	210	220	490	580
	ornamentals (foliar spray) chemigation	2.8	80	acres	0.17	0.13	8.6E-03	0.54	0.42	0.028	180	240	360	52	56	120	140
	ornamentals (soil directed drench) chemigation	77	5	acres	0.17	0.13	8.6E-03	0.94	0.72	0.047	110	140	210	30	32	71	84
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	0.17	0.13	8.6E-03	0.068	0.052	3.4E-03	1,500	1,900	2,900	420	450	980	1,200
	strawberries	0.7	80	acres	0.17	0.13	8.6E-03	0.14	0.10	6.9E-03	740	960	1,500	210	220	490	580
	wheat, soybeans	0.7	200	acres	0.17	0.13	8.6E-03	0.34	0.26	0.017	290	380	580	83	89	200	230
	grapes, potatoes	1	80	acres	0.17	0.13	8.6E-03	0.19	0.15	0.010	510	670	1,000	150	160	340	410
	beans	1.4	80	acres	0.17	0.13	8.6E-03	0.27	0.21	0.014	370	480	730	100	110	240	290

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																	
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
	onions, sod farms	15	80	acres	0.17	0.13	8.6E-03	2.91	2.23	0.15	34	45	68	10	10	23	27
	golf course turf	15	40	acres	0.17	0.13	8.6E-03	1.46	1.11	0.074	69	90	140	19	21	46	54
	ornamentals (foliar spray)	2.8	80	acres	0.17	0.13	8.6E-03	0.54	0.42	0.028	180	240	360	52	56	120	140
	ornamentals (soil drench)	77	5	acres	0.17	0.13	8.6E-03	0.94	0.72	0.047	110	140	210	30	32	71	84
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.7	40	acres	0.17	0.13	8.6E-03	0.068	0.052	3.4E-03	1,500	1,900	2,900	420	450	980	1,200
	apples, apricots, cherries, plums/prunes, nectarines, grapes, potatoes	1	40	acres	0.17	0.13	8.6E-03	0.10	0.07	4.9E-03	1,000	1,300	2,000	290	310	680	810
	almonds	1.4	40	acres	0.17	0.13	8.6E-03	0.14	0.10	6.9E-03	740	960	1,500	210	220	490	580
	peaches	1.6	40	acres	0.17	0.13	8.6E-03	0.16	0.12	7.9E-03	640	840	1,300	200	220	430	510
	ornamentals	2.8	20	acres	0.17	0.13	8.6E-03	0.14	0.10	6.9E-03	740	960	1,500	210	220	490	580
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	0.17	0.13	8.6E-03	0.68	0.52	0.034	150	190	290	42	45	98	120
	ornamental (soil drench) (j)	77	1	acres	0.17	0.13	8.6E-03	0.19	0.14	9.5E-03	530	700	1,100	150	160	360	420
	turf (k)	15	100	acres	0.17	0.13	8.6E-03	3.64	2.79	0.18	27	36	54	8	8	18	22
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gallons	0.17	0.13	8.6E-03	2.9E-03	2.2E-03	1.5E-04	34,000	45,000	68,000	9,700	10,000	23,000	27,000
	cuttings	0.007	100	gallons	0.17	0.13	8.6E-03	1.7E-03	1.3E-03	8.6E-05	59,000	77,000	120,000	17,000	18,000	39,000	46,000

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	0.066	0.047	1.5E-04	0.12	0.082	2.6E-04	870	1,200	38,000	780	1,000	850	1,200
	pecans, strawberries	0.7	350	acres	0.066	0.047	1.5E-04	0.23	0.165	5.3E-04	430	610	19,000	390	520	420	590
	wheat, soybeans	0.7	1200	acres	0.066	0.047	1.5E-04	0.79	0.564	1.8E-03	130	180	5,600	110	150	120	170
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	0.066	0.047	1.5E-04	0.33	0.235	7.5E-04	300	430	13,000	270	370	300	410
	almonds, beans	1.4	350	acres	0.066	0.047	1.5E-04	0.46	0.33	1.1E-03	220	300	9,500	190	260	210	290
	peaches	1.6	350	acres	0.066	0.047	1.5E-04	0.53	0.38	1.2E-03	190	270	8,300	170	230	190	260
	onions, sod farms	15	350	acres	0.066	0.047	1.5E-04	4.95	3.5	0.011	20	28	890	18	24	20	27
	ornamentals (foliar spray) aerial	0.7	80	acres	0.066	0.047	1.5E-04	0.053	0.038	1.2E-04	1,900	2,700	83,000	1,700	2,300	1,900	2,600
	ornamentals (foliar spray) chemigation	2.8	80	acres	0.066	0.047	1.5E-04	0.211	0.15	4.8E-04	470	660	21,000	420	570	460	640
	ornamentals (soil directed drench) chemigation	37	5	acres	0.066	0.047	1.5E-04	0.174	0.12	4.0E-04	570	810	25,000	510	690	560	780
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	0.066	0.047	1.5E-04	0.026	0.019	6.0E-05	3,800	5,300	170,000	3,400	4,600	3,700	5,200
	strawberries	0.7	80	acres	0.066	0.047	1.5E-04	0.053	0.038	1.2E-04	1,900	2,700	83,000	1,700	2,300	1,900	2,600
	wheat, soybeans	0.7	200	acres	0.066	0.047	1.5E-04	0.13	0.094	3.0E-04	760	1,100	33,000	680	910	740	1,000
	beans	1.4	80	acres	0.066	0.047	1.5E-04	0.11	0.075	2.4E-04	950	1,300	42,000	850	1,100	930	1,300
	onions, sod farms	15	80	acres	0.066	0.047	1.5E-04	1.13	0.81	2.6E-03	88	120	3,900	79	110	86	120
	golf course turf	15	40	acres	0.066	0.047	1.5E-04	0.57	0.40	1.3E-03	180	250	7,800	160	210	170	240

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
	ornamentals (foliar spray)	2.8	80	acres	0.066	0.047	1.5E-04	0.21	0.15	4.8E-04	470	660	21,000	420	570	460	640
	ornamentals (soil drench)	37	5	acres	0.066	0.047	1.5E-04	0.17	0.12	4.0E-04	570	810	25,000	510	690	560	780
(2c) Mixing/Loading Dry Flowable/ WDG for Airblast Application	pecans	0.7	40	acres	0.066	0.047	1.5E-04	0.026	0.019	6.0E-05	3,800	5,300	170,000	3,400	4,600	3,700	5,200
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	0.066	0.047	1.5E-04	0.038	0.027	8.6E-05	2,700	3,700	120,000	2,400	3,200	2,600	3,600
	almonds	1.4	40	acres	0.066	0.047	1.5E-04	0.053	0.038	1.2E-04	1,900	2,700	83,000	1,700	2,300	1,900	2,600
	peaches	1.6	40	acres	0.066	0.047	1.5E-04	0.060	0.043	1.4E-04	1,700	2,300	73,000	1,500	2,000	1,600	2,300
	ornamentals	2.8	20	acres	0.066	0.047	1.5E-04	0.053	0.038	1.2E-04	1,900	2,700	83,000	1,700	2,300	1,900	2,600
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	0.066	0.047	1.5E-04	0.26	0.19	6.0E-04	380	530	17,000	340	460	370	520
	ornamental (soil drench) (j)	37	1	acres	0.066	0.047	1.5E-04	0.035	0.025	7.9E-05	2,900	4,000	130,000	2,600	3,500	2,800	3,900
	lawns (k)	15	100	acres	0.066	0.047	1.5E-04	1.4	1.0	3.2E-03	71	99	3,100	63	85	69	96
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gallons	0.066	0.047	1.5E-04	1.1E-03	8.1E-04	2.6E-06	88,000	120,000	3,900,000	79,000	110,000	86,000	120,000
	cuttings	0.007	100	gallons	0.066	0.047	1.5E-04	6.6E-04	4.7E-04	1.5E-06	150,000	210,000	6,700,000	140,000	180,000	150,000	210,000

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																	
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	0.023	0.017	2.4E-04	0.040	0.030	4.2E-04	2,500	3,400	24,000	1,600	2,000	2,200	2,900
	pecans, strawberries, pears	0.7	350	acres	0.023	0.017	2.4E-04	0.081	0.060	8.4E-04	1,200	1,700	12,000	820	990	1,100	1,500
	wheat, soybeans	0.7	1200	acres	0.023	0.017	2.4E-04	0.28	0.20	2.9E-03	360	490	3,500	240	290	330	430
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	0.023	0.017	2.4E-04	0.115	0.085	1.2E-03	870	1,200	8,300	570	690	790	1,000
	almonds, beans	1.4	350	acres	0.023	0.017	2.4E-04	0.16	0.12	1.7E-03	620	840	6,000	410	490	560	740
	peaches	1.6	350	acres	0.023	0.017	2.4E-04	0.18	0.14	1.9E-03	540	740	5,200	360	430	490	640
	sod farms	15	350	acres	0.023	0.017	2.4E-04	1.7	1.3	0.018	58	78	560	38	46	52	69
	ornamentals (foliar spray) aerial	0.7	80	acres	0.023	0.017	2.4E-04	0.018	0.014	1.9E-04	5,400	7,400	52,000	3,600	4,300	4,900	6,400
	ornamentals (foliar spray) chemigation	2.8	80	acres	0.023	0.017	2.4E-04	0.074	0.054	7.7E-04	1,400	1,800	13,000	890	1,100	1,200	1,600
	ornamentals (soil directed drench) chemigation	37	5	acres	0.023	0.017	2.4E-04	0.061	0.045	6.3E-04	1,600	2,200	16,000	1,100	1,300	1,500	2,000
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	0.023	0.017	2.4E-04	9.2E-03	6.8E-03	9.6E-05	11,000	15,000	100,000	7,100	8,600	9,800	13,000
	strawberries	0.7	80	acres	0.023	0.017	2.4E-04	0.018	0.014	1.9E-04	5,400	7,400	52,000	3,600	4,300	4,900	6,400
	wheat, soybeans	0.7	200	acres	0.023	0.017	2.4E-04	0.046	0.034	4.8E-04	2,200	2,900	21,000	1,400	1,700	2,000	2,600
	grapes	1	80	acres	0.023	0.017	2.4E-04	0.026	0.019	2.7E-04	3,800	5,100	36,000	2,500	3,000	3,400	4,500
	beans	1.4	80	acres	0.023	0.017	2.4E-04	0.037	0.027	3.8E-04	2,700	3,700	26,000	1,800	2,200	2,500	3,200
	sod farms	15	80	acres	0.023	0.017	2.4E-04	0.39	0.29	4.1E-03	250	340	2,400	170	200	230	300

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																	
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
	golf course turf	15	40	acres	0.023	0.017	2.4E-04	0.20	0.15	2.1E-03	510	690	4,900	330	400	460	600
	ornamentals (foliar spray)	2.8	80	acres	0.023	0.017	2.4E-04	0.074	0.054	7.7E-04	1,400	1,800	13,000	890	1,100	1,200	1,600
	ornamentals (soil drench)	77	5	acres	0.023	0.017	2.4E-04	0.127	0.094	1.3E-03	790	1,100	7,600	520	630	720	940
(3c) Mixing/ Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.7	40	acres	0.023	0.017	2.4E-04	9.2E-03	6.8E-03	9.6E-05	11,000	15,000	100,000	7,100	8,600	9,800	13,000
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	0.023	0.017	2.4E-04	0.013	0.010	1.4E-04	7,600	10,000	73,000	5,000	6,000	6,900	9,000
	almonds	1.4	40	acres	0.023	0.017	2.4E-04	0.018	0.014	1.9E-04	5,400	7,400	52,000	3,600	4,300	4,900	6,400
	peaches	1.6	40	acres	0.023	0.017	2.4E-04	0.021	0.016	2.2E-04	4,800	6,400	46,000	3,300	4,000	4,300	5,600
	ornamentals	2.8	20	acres	0.023	0.017	2.4E-04	0.018	0.014	1.9E-04	5,400	7,400	52,000	3,600	4,300	4,900	6,400
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	0.023	0.017	2.4E-04	0.092	0.068	9.6E-04	1,100	1,500	10,000	710	860	980	1,300
	ornamental (soil drench) (j)	77	1	acres	0.023	0.017	2.4E-04	0.025	0.019	2.6E-04	4,000	5,300	38,000	2,600	3,100	3,600	4,700
	turf (k)	15	100	acres	0.023	0.017	2.4E-04	0.493	0.36	5.1E-03	200	270	1,900	130	160	180	240
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gallons	0.023	0.017	2.4E-04	3.9E-04	2.9E-04	4.1E-06	250,000	340,000	2,400,000	170,000	200,000	230,000	300,000
	cuttings	0.007	100	gallons	0.023	0.017	2.4E-04	2.3E-04	1.7E-04	2.4E-06	430,000	590,000	4,200,000	290,000	340,000	390,000	520,000

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																	
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	0.0069	0.0034	3.4E-04	0.21	0.105	0.010	470	950	950	140	160	310	480
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	0.0069	0.0034	3.4E-04	0.21	0.105	0.010	470	950	950	140	160	310	480
	turf	11	40	acres	0.0069	0.0034	3.4E-04	0.043	0.021	2.1E-03	2,300	4,700	4,700	670	780	1,500	2,300
		5.4	40	acres	0.0069	0.0034	3.4E-04	0.021	0.010	1.0E-03	4,700	9,500	9,500	1,400	1,600	3,100	4,800
	sod farms	11	80	acres	0.0069	0.0034	3.4E-04	0.087	0.043	4.3E-03	1,200	2,300	2,300	330	390	770	1,200
		5.4	80	acres	0.0069	0.0034	3.4E-04	0.043	0.021	2.1E-03	2,300	4,800	4,800	680	790	1,600	2,400
(5) Loading Dusts (Exposure studies used for UE values) (l)	peanut seeds	0.047	20	acres	0.42	No Data	0.011	0.0056	No Data	1.5E-04	18,000	No Data	68,000	7,600	No Data	14,000	No Data
	potato seed pieces	1.2	30	acres	0.42	No Data	0.011	0.22	No Data	5.7E-03	460	No Data	1,800	200	No Data	370	No Data
Applicator																	
(6) Applying Sprays Aerially	all crops	See Engineering Controls															
(7) Applying Granulars Aerially	ornamentals	27	80	acres	See Engineering Controls	See Engineering Controls	See Engineering Controls										
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	0.014	0.011	1.5E-04	5.6E-03	4.4E-03	6.0E-05	18,000	23,000	170,000	12,000	14,000	16,000	20,000
	strawberries	0.7	80	acres	0.014	0.011	1.5E-04	0.011	8.8E-03	1.2E-04	8,900	11,000	83,000	5,800	6,800	8,100	10,000
	wheat, soybeans	0.7	200	acres	0.014	0.011	1.5E-04	0.028	0.022	3.0E-04	3,600	4,500	33,000	2,300	2,700	3,200	4,000

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																	
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
	grapes, potatoes	1	80	acres	0.014	0.011	1.5E-04	0.016	0.013	1.7E-04	6,300	8,000	58,000	4,100	4,800	5,600	7,000
	beans	1.4	80	acres	0.014	0.011	1.5E-04	0.022	0.018	2.4E-04	4,500	5,700	42,000	2,900	3,400	4,000	5,000
	onions, sod farms	15	80	acres	0.014	0.011	1.5E-04	0.24	0.19	2.6E-03	420	530	3,900	270	320	380	470
	golf course turf	15	40	acres	0.014	0.011	1.5E-04	0.12	0.094	1.3E-03	830	1,100	7,800	700	850	750	930
	ornamentals (foliar spray)	2.8	80	acres	0.014	0.011	1.5E-04	0.045	0.035	4.8E-04	2,200	2,800	21,000	1,500	1,700	2,000	2,500
	ornamentals (soil drench)	77	5	acres	0.014	0.011	1.5E-04	0.077	0.061	8.3E-04	1,300	1,700	12,000	850	990	1,200	1,500
		37	5	acres	0.014	0.011	1.5E-04	0.037	0.029	4.0E-04	2,700	3,400	25,000	1,800	2,100	2,400	3,000
(9) Applying with an Airblast Sprayer	pecans	0.7	40	acres	0.24	0.22	9.0E-04	0.096	0.088	3.6E-04	1,000	1,100	28,000	880	940	1,000	1,100
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	0.24	0.22	9.0E-04	0.14	0.1257	5.1E-04	730	800	19,000	610	660	700	760
	almonds	1.4	40	acres	0.24	0.22	9.0E-04	0.19	0.18	7.2E-04	520	570	14,000	440	470	500	550
	peaches	1.6	40	acres	0.24	0.22	9.0E-04	0.22	0.20	8.2E-04	460	500	12,000	390	420	440	480
	ornamentals	2.8	20	acres	0.24	0.22	9.0E-04	0.19	0.18	7.2E-04	520	570	14,000	440	470	500	550
(10) Applying with a Handgun Sprayer (ORETF Data)	ornamentals (foliar spray)	2.8	5	acres	0.67	0.35	2.0E-04	0.134	0.070	4.0E-05	750	1,400	250,000	740	1,400	740	1,400
	ornamentals (soil drench) (m)	77	0.05	acres	0.67	0.35	2.0E-04	0.037	0.019	1.1E-05	2,700	5,200	910,000	2,700	5,100	2,700	5,200
		37	0.05	acres	0.67	0.35	2.0E-04	1.8E-02	0.0093	5.3E-06	5,600	11,000	1,900,000	5,600	11,000	5,600	11,000
	turf	15	5	acres	0.67	0.35	2.0E-04	0.718	0.375	2.1E-04	140	270	47,000	140	260	140	270

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(11) Applying Granular Formulations with a Tractor-Drawn Spreader	ornamentals	27	40	acres	0.0072	0.0042	2.4E-04	0.111	0.065	3.7E-03	900	1,500	2,700	340	400	680	980
	turf	11	40	acres	0.0072	0.0042	2.4E-04	0.045	0.026	1.5E-03	2,200	3,800	6,600	830	980	1,700	2,400
		5.4	40	acres	0.0072	0.0042	2.4E-04	0.022	0.013	7.4E-04	4,500	7,700	14,000	1,700	2,000	3,400	4,900
(12) Applying Dip Treatment	bulbs	0.012	100	gal-lons	No Data	No Data	No Data										
	cuttings	0.007	100	gal-lons													
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (l)	cutting/sorting	1.2	30	acres	0.038	No Data	5.8E-04	0.023	No Data	3.0E-04	4,400	No Data	34,000	2,700	No Data	3,900	No Data
	planter/operator	1.2	30	acres	See Engineering Controls												
	planter/observer	1.2	30	acres	No Data	No Data	4.0E-04	No Data	No Data	2.1E-04	No Data	No Data	49,000	No Data	No Data	No Data	No Data
Mixer/Loader/Applicator																	
(14) Mixing/Loading/Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007	1000	gal-lons	2.5	1.6	0.024	0.25	0.16	2.4E-03	400	630	4,200	270	360	360	540
(15) Mixing/Loading/Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	8.6	6.2	0.22	0.034	0.025	8.8E-04	2,900	4,000	11,000	1,300	1,500	2,300	3,000
	turf	15	0.5	acres	8.6	6.2	0.22	0.92	0.664	2.4E-02	110	150	420	48	54	86	110

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(16) Mixing/Loading/Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	0.43	0.37	6.0E-03	1.7E-03	1.5E-03	2.4E-05	58,000	68,000	420,000	34,000	37,000	51,000	58,000
	turf	15	0.5	acres	0.43	0.37	6.0E-03	0.047	0.040	6.6E-04	2,100	2,500	15,000	1,300	1,400	1,900	2,100
(17) Mixing/Loading/Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	No Data	No Data	No Data										
	turf	15	0.5	acres													
(18) Mixing/loading/Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	2.5	1.6	0.024	0.010	6.4E-03	9.6E-05	10,000	16,000	100,000	8,900	13,000	9,100	14,000
	turf	15	0.5	acres	2.5	1.6	0.024	0.27	0.171	2.6E-03	370	580	3,900	330	490	340	510
(19a) Mixing/Loading/Applying Liquid Formulations with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.48	0.25	3.8E-04	0.096	0.050	7.6E-05	1,000	2,000	130,000	1,000	1,900	1,000	2,000
	ornamental (soil drench) (m)	77	0.05	acres	0.48	0.25	3.8E-04	0.026	0.014	2.1E-05	3,800	7,300	480,000	3,600	6,800	3,800	7,200
	turf	15	5	acres	0.48	0.25	3.8E-04	0.514	0.268	4.1E-04	190	370	25,000	190	350	190	370

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(19b) Mixing/Loading/Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.53	0.28	4.4E-03	0.11	0.056	8.8E-04	940	1,800	11,000	670	1,000	870	1,500
	ornamental (soil drench) (m)	37	0.05	acres	0.53	0.28	4.4E-03	0.014	7.4E-03	1.2E-04	7,100	14,000	86,000	5,000	7,600	6,600	12,000
	turf	15	5	acres	0.53	0.28	4.4E-03	0.57	0.300	4.7E-03	180	330	2,100	120	190	160	290
(19c) Mixing/Loading/Applying Wettable Powders with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	0.72	0.38	0.012	0.14	0.076	2.5E-03	690	1,300	4,000	370	500	590	990
	ornamental (soil drench) (m)	77	0.05	acres	0.72	0.38	0.012	0.040	0.021	6.8E-04	2,500	4,800	15,000	1,400	1,800	2,200	3,600
	turf	15	5	acres	0.72	0.38	0.012	0.77	0.41	1.3E-02	130	250	750	70	93	110	190
(20) Loading/Applying Granules to Turf using Belly Grinder	ornamentals	27	1	acres	9.3	5.7	0.012	3.6	2.20	4.6E-03	28	45	2,200	26	41	28	45
	turf	11	1	acres	9.3	5.7	0.012	1.5	0.90	1.9E-03	68	110	5,300	64	100	68	110
		5.4	1	acres	9.3	5.7	0.012	0.72	0.44	9.3E-04	140	230	11,000	130	210	140	220

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE																
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data)	ornamentals	27	5	acres	0.22	0.11	0.0015	0.42	0.21	2.9E-03	240	470	3,500	180	280	220	410
	lawns, golf courses	11	5	acres	0.22	0.11	0.0015	0.17	0.086	1.2E-03	580	1,200	8,500	430	690	540	1,000
		5.4	5	acres	0.22	0.11	0.0015	0.085	0.042	5.8E-04	1,200	2,400	17,000	880	1,400	1,100	2,100
(22) Loading/Applying Dust as a Seed Treatment (dry) in planter box (Fenske et al., 1990 used for UE value) (o)	peanuts	0.047	20	acres	10.4	No Data	0.00048	0.140	No Data	6.4E-06	720	No Data	1,600,000	710	No Data	720	No Data
(23) Mixing/Loading/Applying a Dip Treatment	bulbs	0.012	100	gallons	No Data	No Data											
	cuttings	0.007	100	gallons	No Data												
Flagger																	
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	NG	0.01	7.0E-05	NG	0.018	1.2E-04	NG	5,700	82,000	NG	4,200	NG	5,300
	pecans, pears, strawberries	0.7	350	acres	NG	0.01	7.0E-05	NG	0.035	2.5E-04	NG	2,900	41,000	NG	2,100	NG	2,700

Table 7a: Thiophanate-methyl: Occupational Handler Short- and Intermediate-term Non-Cancer Exposure and Risk Estimates with Additional PPE

Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acre-age or other Daily Unit (b)	Units	Single Layer + Glove Dermal UE (mg/lb ai) (c)	Double Layer + Glove Dermal UE (mg/lb ai) (c)	Dust/Mist Respirator Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) single layer + gloves (e)	Dermal Dose (mg/kg/day) double layer + gloves (e)	Inhalation Dose (mg/kg/day) dust/mist respirator (f)	Dermal MOE: single layer + gloves (g)	Dermal MOE: double layer + gloves (g)	Inhalation MOE: Dust/Mist Respirator (h)	Total MOE: single layer + gloves (i)	Total MOE: double layer + gloves (i)	Total MOE: single layer + gloves + respirator (i)	Total MOE: double layer + gloves + respirator (i)
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	NG	0.01	7.0E-05	NG	0.050	3.5E-04	NG	2,000	29,000	NG	1,500	NG	1,900
	almonds, beans	1.4	350	acres	NG	0.01	7.0E-05	NG	0.070	4.9E-04	NG	1,400	20,000	NG	1,100	NG	1,300
	peaches	1.6	350	acres	NG	0.01	7.0E-05	NG	0.080	5.6E-04	NG	1,300	18,000	NG	930	NG	1,200
	onions, sod farms	15	350	acres	NG	0.01	7.0E-05	NG	0.750	5.3E-03	NG	130	1,900	NG	99	NG	120
	ornamentals (foliar spray)	2.8	80	acres	NG	0.01	7.0E-05	NG	0.032	2.2E-04	NG	3,100	45,000	NG	2,300	NG	2,900
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	No Data	0.0016	3.0E-05	No Data	0.049	9.3E-04	No Data	2,000	11,000	No Data	1,000	No Data	1,700

Footnotes:

a Application rates are the maximum application rates determined from EPA registered labels, except where specific turf and ornamental rates supplied by registrant are also shown.

b Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available. Ornamental acres treated aerially is based on person communication with ANLA on 12/7/00. Lawn and ornamental rate estimates are explained in footnotes j-m below.

c Unit Exposure (UE): Unless otherwise footnoted dermal unit exposure values from PHED Surrogate Exposure Guide, draft version August, 1998. Baseline or single layer dermal exposure assumes long pants, long sleeved shirt, no gloves, open mixing/loading, open cab/tractor; double layer assumes an additional 50% reduction in exposure to legs, arms and torso from coveralls over single layer (unless actually measured); gloves are chemical resistant gloves which are assumed to afford 90% protection compared to baseline, unless gloved data available (see Assumptions Table 23).

d Unless otherwise footnoted, inhalation unit exposure values from PHED Surrogate Exposure Guide, draft version August, 1998. Baseline inhalation exposure assessed as a no respirator scenario; "respirator" represents use of a dust mist respirator -- calculated using an 80% protection factor from baseline inhalation exposure values.

e Dermal dose = dermal unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).

f Inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).

g Short/Intermediate-term dermal MOE = NOAEL (100 mg/kg/day / daily dermal dose (mg/kg/day). Where daily

h Short/Intermediate-term inhalation MOE = NOAEL (10 mg/kg/day / daily inhalation dose (mg/kg/day). Where daily

i Short/Intermediate-term total MOE = 1 / 1/dermal MOE) + (1/inhalation MOE).

j Represents support of 20 LCO trucks holding 500 gallons of solution each. These 20 trucks could apply 10,000 gallons of TM solution to 1 acre for a drench treatment.

k Represents support of 20 LCO trucks which can treat 5 acres each.

l Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

m Represents 1 truck holding 500 gallons of TM solution which could treat 0.05 acres (1/20th of an acre which receives 10,000 gallons/acre) as a drench treatment.

n For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.

(o) Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)

NA = not applicable
NG = (No gloves) Best available data indicates wearing gloves while flagging is not an effective exposure control.

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
Mixer/Loader												
(1a) Mixing/Loading Wettable Powder for Aerial/ Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	5.4E-06	5.4E-05	5.2E-06	5.2E-05	1.8E-06	1.8E-05
	pecans, strawberries, pears	0.6	350	acres	3	30	9.3E-06	9.3E-05	8.9E-06	8.9E-05	3.0E-06	3.0E-05
	wheat, soybeans	0.7	1200	acres	3	30	3.7E-05	3.7E-04	3.5E-05	3.5E-04	1.2E-05	1.2E-04
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	1.6E-05	1.6E-04	1.5E-05	1.5E-04	5.0E-06	5.0E-05
	almonds, beans	1	350	acres	3	30	1.6E-05	1.6E-04	1.5E-05	1.5E-04	5.0E-06	5.0E-05
	peaches	1.3	350	acres	3	30	2.0E-05	2.0E-04	1.9E-05	1.9E-04	6.5E-06	6.5E-05
	onions, sod farms	11	350	acres	3	30	1.7E-04	1.7E-03	1.6E-04	1.6E-03	5.5E-05	5.5E-04
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	1.4E-05	NA	1.4E-05	NA	4.6E-06
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	7.5E-06	NA	7.1E-06	NA	2.4E-06	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	8.2E-06	2.5E-05	7.8E-06	2.3E-05	2.7E-06	8.0E-06
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	1.2E-06	1.2E-05	1.2E-06	1.2E-05	4.0E-07	4.0E-06
	strawberries	0.6	80	acres	3	30	2.1E-06	2.1E-05	2.0E-06	2.0E-05	6.9E-07	6.9E-06
	wheat, soybeans	0.7	200	acres	3	30	6.2E-06	6.2E-05	5.9E-06	5.9E-05	2.0E-06	2.0E-05
	grapes, potatoes	1	80	acres	3	30	3.6E-06	3.6E-05	3.4E-06	3.4E-05	1.1E-06	1.1E-05
	beans	1	80	acres	3	30	3.6E-06	3.6E-05	3.4E-06	3.4E-05	1.1E-06	1.1E-05
	onions, sod farms	11	80	acres	3	30	3.9E-05	3.9E-04	3.7E-05	3.7E-04	1.3E-05	1.3E-04

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	golf course turf	11	40	acres	3	9	2.0E-05	5.9E-05	1.9E-05	5.6E-05	6.3E-06	1.9E-05
	ornamentals (foliar spray)	2.1	40	acres	3	9	3.7E-06	1.1E-05	3.5E-06	1.1E-05	1.2E-06	3.6E-06
	ornamentals (soil drench)	37	5	acres	3	9	8.2E-06	2.5E-05	7.8E-06	2.3E-05	2.7E-06	8.0E-06
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.6	40	acres	3	30	1.1E-06	1.1E-05	1.0E-06	1.0E-05	3.4E-07	3.4E-06
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	1.8E-06	1.8E-05	1.7E-06	1.7E-05	5.7E-07	5.7E-06
	almonds	1	40	acres	3	30	1.8E-06	1.8E-05	1.7E-06	1.7E-05	5.7E-07	5.7E-06
	peaches	1.3	40	acres	3	30	2.3E-06	2.3E-05	2.2E-06	2.2E-05	7.5E-07	7.5E-06
	ornamentals	2.1	20	acres	3	30	1.9E-06	1.9E-05	1.8E-06	1.8E-05	6.0E-07	6.0E-06
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	9.3E-06	9.3E-05	8.9E-06	8.9E-05	3.0E-06	3.0E-05
	ornamental (soil drench)	37	1	acres	3	30	1.6E-06	1.6E-05	1.6E-06	1.6E-05	5.3E-07	5.3E-06
	turf (f)	5.4	100	acres	3	30	2.4E-05	2.4E-04	2.3E-05	2.3E-04	7.7E-06	7.7E-05
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gallons	3	30	5.3E-08	5.3E-07	5.1E-08	5.1E-07	1.7E-08	1.7E-07
	cuttings	0.007	100	gallons	3	9	3.1E-08	9.3E-08	3.0E-08	8.9E-08	1.0E-08	3.0E-08

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	5.3E-07	5.3E-06	4.0E-07	4.0E-06	3.4E-07	3.4E-06
	pecans, strawberries	0.6	350	acres	3	30	9.2E-07	9.2E-06	6.9E-07	6.9E-06	5.9E-07	5.9E-06
	wheat, soybeans	0.7	1200	acres	3	30	3.7E-06	3.7E-05	2.8E-06	2.8E-05	2.3E-06	2.3E-05
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	3	30	1.5E-06	1.5E-05	1.2E-06	1.2E-05	9.8E-07	9.8E-06
	almonds, beans	1	350	acres	3	30	1.5E-06	1.5E-05	1.2E-06	1.2E-05	9.8E-07	9.8E-06
	peaches	1.3	350	acres	3	30	2.0E-06	2.0E-05	1.5E-06	1.5E-05	1.3E-06	1.3E-05
	onions, sod farms	11	350	acres	3	30	1.7E-05	1.7E-04	1.3E-05	1.3E-04	1.1E-05	1.1E-04
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	1.4E-06	NA	1.1E-06	NA	8.9E-07
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	7.3E-07	NA	5.5E-07	NA	4.7E-07	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	8.1E-07	2.4E-06	6.1E-07	1.8E-06	5.2E-07	1.5E-06
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	1.2E-07	1.2E-06	9.2E-08	9.2E-07	7.8E-08	7.8E-07
	strawberries	0.6	80	acres	3	30	2.1E-07	2.1E-06	1.6E-07	1.6E-06	1.3E-07	1.3E-06
	wheat, soybeans	0.7	200	acres	3	30	6.1E-07	6.1E-06	4.6E-07	4.6E-06	3.9E-07	3.9E-06
	beans	1	80	acres	3	30	3.5E-07	3.5E-06	2.6E-07	2.6E-06	2.2E-07	2.2E-06

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	onions, sod farms	11	80	acres	3	30	3.8E-06	3.8E-05	2.9E-06	2.9E-05	2.5E-06	2.5E-05
	golf course turf	11	40	acres	3	9	1.9E-06	5.8E-06	1.4E-06	4.3E-06	1.2E-06	3.7E-06
	ornamentals (foliar spray)	2.1	80	acres	3	9	7.3E-07	2.2E-06	5.5E-07	1.7E-06	4.7E-07	1.4E-06
	ornamentals (soil drench)	37	5	acres	3	9	8.1E-07	2.4E-06	6.1E-07	1.8E-06	5.2E-07	1.5E-06
(2c) Mixing/Loading Dry Flowable/WDG for Airblast Application	pecans	0.6	40	acres	3	30	1.0E-07	1.0E-06	7.9E-08	7.9E-07	6.7E-08	6.7E-07
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	3	30	1.7E-07	1.7E-06	1.3E-07	1.3E-06	1.1E-07	1.1E-06
	almonds	1	40	acres	3	30	1.7E-07	1.7E-06	1.3E-07	1.3E-06	1.1E-07	1.1E-06
	peaches	1.3	40	acres	3	30	2.3E-07	2.3E-06	1.7E-07	1.7E-06	1.4E-07	1.4E-06
	ornamentals	2.1	20	acres	3	30	1.8E-07	1.8E-06	1.4E-07	1.4E-06	1.2E-07	1.2E-06
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	9.2E-07	9.2E-06	6.9E-07	6.9E-06	5.9E-07	5.9E-06
	ornamental (soil drench)	37	1	acres	3	30	1.6E-07	1.6E-06	1.2E-07	1.2E-06	1.0E-07	1.0E-06
	lawns	5.4	100	acres	3	30	2.4E-06	2.4E-05	1.8E-06	1.8E-05	1.5E-06	1.5E-05
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gallons	3	30	5.2E-09	5.2E-08	3.9E-09	3.9E-08	3.3E-09	3.3E-08

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	cuttings	0.007	100	gallons	3	9	3.1E-09	9.2E-09	2.3E-09	6.9E-09	2.0E-09	5.9E-09
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	2.8E-07	2.8E-06	2.4E-07	2.4E-06	1.4E-07	1.4E-06
	pecans, strawberries, pears	0.6	350	acres	3	30	4.8E-07	4.8E-06	4.1E-07	4.1E-06	2.4E-07	2.4E-06
	wheat, soybeans	0.7	1200	acres	3	30	1.9E-06	1.9E-05	1.6E-06	1.6E-05	9.7E-07	9.7E-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	3	30	8.0E-07	8.0E-06	6.8E-07	6.8E-06	4.1E-07	4.1E-06
	almonds, beans	1	350	acres	3	30	8.0E-07	8.0E-06	6.8E-07	6.8E-06	4.1E-07	4.1E-06
	peaches	1.3	350	acres	3	30	1.0E-06	1.0E-05	8.8E-07	8.8E-06	5.3E-07	5.3E-06
	sod farms	11	350	acres	3	30	8.8E-06	8.8E-05	7.5E-06	7.5E-05	4.5E-06	4.5E-05
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	NA	7.3E-07	NA	6.2E-07	NA	3.7E-07
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	3.8E-07	NA	3.3E-07	NA	1.9E-07	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	4.2E-07	1.3E-06	3.6E-07	1.1E-06	2.1E-07	6.4E-07
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	6.4E-08	6.4E-07	5.4E-08	5.4E-07	3.2E-08	3.2E-07

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	strawberries	0.6	80	acres	3	30	1.1E-07	1.1E-06	9.3E-08	9.3E-07	5.6E-08	5.6E-07
	wheat, soybeans	0.7	200	acres	3	30	3.2E-07	3.2E-06	2.7E-07	2.7E-06	1.6E-07	1.6E-06
	grapes	1	80	acres	3	30	1.8E-07	1.8E-06	1.5E-07	1.5E-06	9.3E-08	9.3E-07
	beans	1	80	acres	3	30	1.8E-07	1.8E-06	1.5E-07	1.5E-06	9.3E-08	9.3E-07
	sod farms	11	80	acres	3	30	2.0E-06	2.0E-05	1.7E-06	1.7E-05	1.0E-06	1.0E-05
	golf course turf	11	40	acres	3	9	1.0E-06	3.0E-06	8.5E-07	2.6E-06	5.1E-07	1.5E-06
	ornamentals (foliar spray)	2.1	80	acres	3	9	3.8E-07	1.1E-06	3.3E-07	9.8E-07	1.9E-07	5.8E-07
	ornamentals (soil drench)	37	5	acres	3	9	4.2E-07	1.3E-06	3.6E-07	1.1E-06	2.1E-07	6.4E-07
(3c) Mixing/Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.6	40	acres	3	30	5.5E-08	5.5E-07	4.6E-08	4.6E-07	2.8E-08	2.8E-07
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	9.1E-08	9.1E-07	7.7E-08	7.7E-07	4.6E-08	4.6E-07
	almonds	1	40	acres	3	30	9.1E-08	9.1E-07	7.7E-08	7.7E-07	4.6E-08	4.6E-07
	peaches	1.3	40	acres	3	30	1.2E-07	1.2E-06	1.0E-07	1.0E-06	6.0E-08	6.0E-07
	ornamentals	2.1	20	acres	3	30	9.6E-08	9.6E-07	8.1E-08	8.1E-07	4.9E-08	4.9E-07
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	4.8E-07	4.8E-06	4.1E-07	4.1E-06	2.4E-07	2.4E-06

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	ornamental (soil drench)	37	1	acres	3	30	8.4E-08	8.4E-07	7.2E-08	7.2E-07	4.3E-08	4.3E-07
	turf (f)	5.4	100	acres	3	30	1.2E-06	1.2E-05	1.0E-06	1.0E-05	6.3E-07	6.3E-06
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gallons	3	30	2.7E-09	2.7E-08	2.3E-09	2.3E-08	1.4E-09	1.4E-08
	cuttings	0.007	100	gallons	3	9	1.6E-09	4.8E-09	1.4E-09	4.1E-09	8.1E-10	2.4E-09
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	NA	24	NA	3.1E-05	NA	2.7E-05	NA	8.1E-06
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	3	30	3.8E-06	3.8E-05	3.4E-06	3.4E-05	1.0E-06	1.0E-05
	turf	11	40	acres	3	9	7.8E-07	2.3E-06	6.9E-07	2.1E-06	2.1E-07	6.2E-07
		5.4	40	acres	3	9	3.8E-07	1.1E-06	3.4E-07	1.0E-06	1.0E-07	3.0E-07
	sod farms	11	80	acres	3	30	1.6E-06	1.6E-05	1.4E-06	1.4E-05	4.1E-07	4.1E-06
		5.4	80	acres	3	30	7.6E-07	7.6E-06	6.8E-07	6.8E-06	2.0E-07	2.0E-06
(5) Loading Dusts (Exposure studies used for UE values) (g)	peanut seeds	0.047	20	acres	3	10	6.5E-08	2.2E-07	No Data	No Data	No Data	No Data
	potato seed pieces	1.2	30	acres	3	10	2.5E-06	8.3E-06	No Data	No Data	No Data	No Data

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
					Applicator							
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	acres	NA	30	See Engineering Controls (Closed Cockpit)					
	pecans, strawberries, pears	0.6	350	acres	NA	30						
	wheat, soybeans	0.7	1200	acres	NA	30						
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	NA	30						
	almonds, beans	1	350	acres	NA	30						
	peaches	1.3	350	acres	NA	30						
	onions, sod farms	11	350	acres	NA	30						
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24						
(7) Applying Granulars Aerially	ornamentals	27	80	acres	NA	30	See Engineering Controls (Closed Cockpit)					
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	3.9E-08	3.9E-07	3.4E-08	3.4E-07	2.1E-08	2.1E-07
	strawberries	0.6	80	acres	3	30	6.7E-08	6.7E-07	5.9E-08	5.9E-07	3.6E-08	3.6E-07
	wheat, soybeans	0.7	200	acres	3	30	2.0E-07	2.0E-06	1.7E-07	1.7E-06	1.0E-07	1.0E-06
	grapes, potatoes	1	80	acres	3	30	1.1E-07	1.1E-06	9.8E-08	9.8E-07	6.0E-08	6.0E-07
	beans	1	80	acres	3	30	1.1E-07	1.1E-06	9.8E-08	9.8E-07	6.0E-08	6.0E-07

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	onions, sod farms	11	80	acres	3	30	1.2E-06	1.2E-05	1.1E-06	1.1E-05	6.6E-07	6.6E-06
	golf course turf	11	40	acres	3	30	6.1E-07	6.1E-06	5.4E-07	5.4E-06	3.3E-07	3.3E-06
	ornamentals (foliar spray)	2.1	80	acres	3	9	2.3E-07	7.0E-07	2.1E-07	6.2E-07	1.3E-07	3.8E-07
	ornamentals (soil drench)	37	5	acres	3	9	2.6E-07	7.7E-07	2.3E-07	6.8E-07	1.4E-07	4.1E-07
(9) Applying with an Airblast Sprayer	pecans, pears	0.6	40	acres	3	30	4.1E-07	4.1E-06	3.9E-07	3.9E-06	3.2E-07	3.2E-06
	apples, apricots, cherries, plums/prunes, nectarines, grapes, potatoes	1	40	acres	3	30	6.9E-07	6.9E-06	6.4E-07	6.4E-06	5.3E-07	5.3E-06
	almonds	1	40	acres	3	30	6.9E-07	6.9E-06	6.4E-07	6.4E-06	5.3E-07	5.3E-06
	peaches	1.3	40	acres	3	30	9.0E-07	9.0E-06	8.4E-07	8.4E-06	6.9E-07	6.9E-06
	ornamentals	2.1	20	acres	3	30	7.2E-07	7.2E-06	6.8E-07	6.8E-06	5.5E-07	5.5E-06
(10) Applying with a Handgun Sprayer (ORETF Data)	ornamentals (foliar spray)	2.1	5	acres	3	30	4.1E-07	4.1E-06	2.2E-07	2.2E-06	2.1E-07	2.1E-06
	ornamentals (soil drench) (h)	37	0.05	acres	3	30	7.2E-08	7.2E-07	3.8E-08	3.8E-07	3.7E-08	3.7E-07
	turf	5.4	5	acres	3	30	1.1E-06	1.1E-05	5.7E-07	5.7E-06	5.4E-07	5.4E-06
(11) Applying Granulars with Tractor-Drawn Spreader	ornamentals	27	40	acres	3	30	1.5E-06	1.5E-05	1.3E-06	1.3E-05	4.7E-07	4.7E-06
	turf	5.4	40	acres	3	30	3.0E-07	3.0E-06	2.6E-07	2.6E-06	9.3E-08	9.3E-07
(12) Applying Dip Treatment	bulbs	0.012	100	gallons	3	30	No Data	No Data	No Data	No Data	No Data	No Data

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	cuttings	0.007	100	gallons	3	9						
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (g)	cutting/sorting	1.2	30	acres	3	10	1.6E-07	5.4E-07	No Data	No Data	No Data	No Data
	planter/operator	1.2	30	acres	3	10	See Engineering Controls					
	planter/observer	1.2	30	acres	3	10	No Data					
Mixer/Loader/Applicator												
(14) Mixing/Loading/ Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007	1000	gallons	3	9	1.7E-06	5.0E-06	1.3E-06	3.9E-06	7.7E-07	2.3E-06
(15) Mixing/Loading/ Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	6.4E-07	3.9E-06	5.8E-07	3.5E-06	2.5E-07	1.5E-06
	turf (i)	5.4	0.5	acres	5	30	6.2E-06	3.7E-05	5.6E-06	3.4E-05	2.4E-06	1.4E-05
(16) Mixing/Loading/ Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	2.3E-08	1.4E-07	2.1E-08	1.3E-07	1.2E-08	7.2E-08

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	turf (i)	5.4	0.5	acres	5	30	2.2E-07	1.3E-06	2.0E-07	1.2E-06	1.2E-07	7.0E-07
(17) Mixing/Loading/ Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	No Data					
	turf (i)	5.4	0.5	acres	5	30	No Data					
(18) Mixing/loading/Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007	40	gallons	5	30	7.8E-08	4.7E-07	5.4E-08	3.2E-07	5.1E-08	3.1E-07
	turf (i)	5.4	0.5	acres	5	30	7.5E-07	4.5E-06	5.2E-07	3.1E-06	5.0E-07	3.0E-06
(19a) Mixing/Loading/ Applying Liquids with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	3.0E-07	3.0E-06	1.7E-07	1.7E-06	1.5E-07	1.5E-06
	ornamental (soil drench) (h)	37	0.05	acres	3	30	5.3E-08	5.3E-07	2.9E-08	2.9E-07	2.7E-08	2.7E-07
	turf	5.4	5	acres	3	30	7.8E-07	7.8E-06	4.2E-07	4.2E-06	3.9E-07	3.9E-06

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
(19b) Mixing/Loading/ Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	3.3E-07	3.3E-06	1.9E-07	1.9E-06	1.7E-07	1.7E-06
	ornamental (soil drench) (h)	37	0.05	acres	3	30	5.9E-08	5.9E-07	3.3E-08	3.3E-07	3.0E-08	3.0E-07
	turf	5.4	5	acres	3	30	8.6E-07	8.6E-06	4.8E-07	4.8E-06	4.4E-07	4.4E-06
(19c) Mixing/Loading/ Applying Wettable Powder Formulations with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.1	5	acres	3	30	9.6E-07	9.6E-06	7.5E-07	7.5E-06	3.3E-07	3.3E-06
	ornamental (soil drench) (h)	37	0.05	acres	3	30	1.7E-07	1.7E-06	1.3E-07	1.3E-06	5.8E-08	5.8E-07
	turf	5.4	5	acres	3	30	2.5E-06	2.5E-05	1.9E-06	1.9E-05	8.5E-07	8.5E-06
(20) Loading/Applying Granules to Turf using Belly Grinder	ornamentals	27	1	acres	3	30	1.6E-05	1.6E-04	1.0E-05	1.0E-04	9.0E-06	9.0E-05
	turf	11	1	acres	3	30	6.4E-06	6.4E-05	4.1E-06	4.1E-05	3.7E-06	3.7E-05
		5.4	1	acres	3	30	3.1E-06	3.1E-05	2.0E-06	2.0E-05	1.8E-06	1.8E-05

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data)	ornamentals	27	5	acres	3	30	2.7E-06	2.7E-05	1.7E-06	1.7E-05	1.1E-06	1.1E-05
	turf including golf courses	11	5	acres	3	30	1.1E-06	1.1E-05	7.1E-07	7.1E-06	4.4E-07	4.4E-06
		5.4	5	acres	3	30	5.3E-07	5.3E-06	3.5E-07	3.5E-06	2.2E-07	2.2E-06
(22) Mixing/Loading/ Applying Dust as a Seed Treatment (dry) in planter box (Fenske et al., 1990 used for UE value) (j)	peanuts	0.047	20	acres	3	30	5.6E-07	5.6E-06	NA	NA	NA	NA
(23) Mixing/Loading/ Applying a Dip Treatment	bulbs	0.012	100	gallons	3	30	No Data	No Data	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons	3	9						
Flagger												
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	NG	NG	1.0E-07	1.0E-06	7.6E-08	7.6E-07
	pecans, pears, strawberries	0.6	350	acres	3	30	NG	NG	1.8E-07	1.8E-06	1.3E-07	1.3E-06
	wheat, soybeans	0.7	350	acres	3	30	NG	NG	2.1E-07	2.1E-06	1.5E-07	1.5E-06

Table 7b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates with Additional PPE												
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Private Applicator Cancer Risk (single layer + gloves + baseline inhalation) (e)	Commercial Applicator Cancer Risk (single layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves) (e)	Commercial Applicator Cancer Risk (double layer + gloves) (e)	Private Applicator Cancer Risk (double layer + gloves + respirator) (e)	Commercial Applicator Cancer Risk (double layer + gloves + respirator) (e)
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	NG	NG	3.0E-07	3.0E-06	2.2E-07	2.2E-06
	almonds, beans	1	350	acres	3	30	NG	NG	3.0E-07	3.0E-06	2.2E-07	2.2E-06
	peaches	1.3	350	acres	3	30	NG	NG	3.9E-07	3.9E-06	2.8E-07	2.8E-06
	onions, sod farms	11	350	acres	3	30	NG	NG	3.3E-06	3.3E-05	2.4E-06	2.4E-05
	ornamentals (foliar spray)	2.1	80	acres	3	24	NG	NG	1.4E-07	1.1E-06	1.0E-07	8.4E-07
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	3	24	NG	NG	4.6E-07	3.7E-06	2.5E-07	2.0E-06

Footnotes:

a Application rates used were "typical rates" where available from BEAD surveys or information provided by the registrants. Where such information was not available, maximum application rates were determined from EPA registered labels.

b Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available. Ornamental acres treated aerially is based on person communication with ANLA on 12/7/00. Turf and ornamental rate estimates explained in footnotes i-k below.

c Private applicator treatments per year are based on treatments to an individual site (e.g., farm, nursery, golf course) and represents number of days per year of expected exposure. Best professional judgment and BEAD data were used in determining treatment day estimates (e.g., facility or farm size / acres per day in footnote b = exposure days / year).

d Commercial applicator treatments per year are based on treatment of multiple sites or farms and represents number of days per year of expected exposure.

e Cancer Risk = Total LADD (mg/kg/day) x Q_1*. Where Q_1* is 0.0138 mg/kg/day^{-1}.
Total LADD (mg/kg/day) = ADD (mg/kg/day) x treatment days per year (for private or commercial as appropriate) / 365 days/year x 35 years worked / 70 year lifetime.
ADD (mg/kg/day) = absorbed daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day) where absorbed daily dermal dose = dermal unit exposure (mg/lb ai) x typical application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) x dermal absorption factor (7%) / body weight (70 kg adult), and inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70).

f Represents support of 20 LCO trucks which can treat 5 acres each.

g Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

h Represents 1 truck holding 500 gallons of TM solution which could treat 0.05 acres (1/20th of an acre which receives 10,000 gallons/acre) as a drench treatment. .

i For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.

j Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)

NA = not applicable

NG = (No gloves) Best available data indicates wearing gloves while flagging is not an effective exposure control.

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
Mixer/Loader											
(1a) Mixing/Loading Wettable Powder for Aerial/ Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	9.8E-03	2.4E-04	0.017	4.2E-04	5,800	24,000	4,700
	pecans, strawberries, pears	0.7	350	acres	9.8E-03	2.4E-04	0.034	8.4E-04	2,900	12,000	2,300
	wheat, soybeans	0.7	1200	acres	9.8E-03	2.4E-04	0.118	2.9E-03	850	3,500	680
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	9.8E-03	2.4E-04	0.049	1.2E-03	2,000	8,300	1,600
	almonds, beans	1.4	350	acres	9.8E-03	2.4E-04	0.069	1.7E-03	1,500	6,000	1,200
	peaches	1.6	350	acres	9.8E-03	2.4E-04	0.078	1.9E-03	1,300	5,200	1,000
	onions, sod farms	15	350	acres	9.8E-03	2.4E-04	0.735	1.8E-02	140	560	110
	ornamentals (foliar spray) aerial	0.7	80	acres	9.8E-03	2.4E-04	0.0078	1.9E-04	13,000	52,000	10,000
	ornamentals (foliar spray) chemigation	2.8	80	acres	9.8E-03	2.4E-04	0.031	7.7E-04	3,200	13,000	2,600
	ornamentals (soil directed drench) chemigation	77	5	acres	9.8E-03	2.4E-04	0.054	1.3E-03	1,900	7,600	1,500
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	9.8E-03	2.4E-04	0.0039	9.6E-05	26,000	100,000	20,000
	strawberries	0.7	80	acres	9.8E-03	2.4E-04	0.0078	1.9E-04	13,000	52,000	10,000
	wheat, soybeans	0.7	200	acres	9.8E-03	2.4E-04	0.020	4.8E-04	5,100	21,000	4,100
	grapes, potatoes	1	80	acres	9.8E-03	2.4E-04	0.011	2.7E-04	8,900	36,000	7,200
	beans	1.4	80	acres	9.8E-03	2.4E-04	0.016	3.8E-04	6,400	26,000	5,100
	onions, sod farms	15	80	acres	9.8E-03	2.4E-04	0.17	4.1E-03	600	2,400	480
	golf course turf	15	40	acres	9.8E-03	2.4E-04	0.084	2.1E-03	1,200	4,900	960
	ornamentals (foliar spray)	2.8	80	acres	9.8E-03	2.4E-04	0.031	7.7E-04	3,200	13,000	2,600
	ornamentals (soil drench)	77	5	acres	9.8E-03	2.4E-04	0.054	1.3E-03	1,900	7,600	1,500
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.7	40	acres	9.8E-03	2.4E-04	3.9E-03	9.6E-05	26,000	100,000	20,000
	apples, apricots, cherries, plums/prunes, nectarines, grapes, potatoes	1	40	acres	9.8E-03	2.4E-04	5.6E-03	1.4E-04	18,000	73,000	14,000
	almonds	1.4	40	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
	peaches	1.6	40	acres	9.8E-03	2.4E-04	9.0E-03	2.2E-04	11,000	46,000	9,000

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
	ornamentals	2.8	20	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	9.8E-03	2.4E-04	0.039	9.6E-04	2,600	10,000	2,000
	ornamental (soil drench) (j)	77	1	acres	9.8E-03	2.4E-04	0.011	2.6E-04	9,300	38,000	7,500
	turf (k)	15	100	acres	9.8E-03	2.4E-04	0.210	5.1E-03	480	1,900	380
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gallons	9.8E-03	2.4E-04	1.7E-04	4.1E-06	600,000	2,400,000	480,000
	cuttings	0.007	100	gallons	9.8E-03	2.4E-04	9.8E-05	2.4E-06	1,000,000	4,200,000	820,000
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	9.8E-03	2.4E-04	0.017	4.2E-04	5,800	24,000	4,700
	pecans, strawberries	0.7	350	acres	9.8E-03	2.4E-04	0.034	8.4E-04	2,900	12,000	2,300
	wheat, soybeans	0.7	1200	acres	9.8E-03	2.4E-04	0.12	2.9E-03	850	3,500	680
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	9.8E-03	2.4E-04	0.049	1.2E-03	2,000	8,300	1,600
	almonds, beans	1.4	350	acres	9.8E-03	2.4E-04	0.069	1.7E-03	1,500	6,000	1,200
	peaches	1.6	350	acres	9.8E-03	2.4E-04	0.078	1.9E-03	1,300	5,200	1,000
	onions, sod farms	15	350	acres	9.8E-03	2.4E-04	0.735	1.8E-02	140	560	110
	ornamentals (foliar spray) aerial	0.7	80	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
	ornamentals (foliar spray) chemigation	2.8	80	acres	9.8E-03	2.4E-04	0.031	7.7E-04	3,200	13,000	2,600
	ornamentals (soil directed drench) chemigation	37	5	acres	9.8E-03	2.4E-04	0.026	6.3E-04	3,900	16,000	3,100
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	9.8E-03	2.4E-04	3.9E-03	9.6E-05	26,000	100,000	20,000
	strawberries	0.7	80	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
	wheat, soybeans	0.7	200	acres	9.8E-03	2.4E-04	0.020	4.8E-04	5,100	21,000	4,100
	beans	1.4	80	acres	9.8E-03	2.4E-04	0.016	3.8E-04	6,400	26,000	5,100
	onions, sod farms	15	80	acres	9.8E-03	2.4E-04	0.17	4.1E-03	600	2,400	480
	golf course turf	15	40	acres	9.8E-03	2.4E-04	0.084	2.1E-03	1,200	4,900	960
	ornamentals (foliar spray)	2.8	80	acres	9.8E-03	2.4E-04	0.031	7.7E-04	3,200	13,000	2,600

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
	ornamentals (soil drench)	37	5	acres	9.8E-03	2.4E-04	0.026	6.3E-04	3,900	16,000	3,100
(2c) Mixing/Loading Dry Flowable/WDG for Airblast Application	pecans	0.7	40	acres	9.8E-03	2.4E-04	3.9E-03	9.6E-05	26,000	100,000	20,000
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	9.8E-03	2.4E-04	5.6E-03	1.4E-04	18,000	73,000	14,000
	almonds	1.4	40	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
	peaches	1.6	40	acres	9.8E-03	2.4E-04	9.0E-03	2.2E-04	11,000	46,000	9,000
	ornamentals	2.8	20	acres	9.8E-03	2.4E-04	7.8E-03	1.9E-04	13,000	52,000	10,000
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	9.8E-03	2.4E-04	0.039	9.6E-04	2,600	10,000	2,000
	ornamental (soil drench) (j)	37	1	acres	9.8E-03	2.4E-04	5.2E-03	1.3E-04	19,000	79,000	16,000
	lawns (k)	15	100	acres	9.8E-03	2.4E-04	0.21	5.1E-03	480	1,900	380
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gal-lons	9.8E-03	2.4E-04	1.7E-04	4.1E-06	600,000	2,400,000	480,000
	cuttings	0.007	100	gal-lons	9.8E-03	2.4E-04	9.8E-05	2.4E-06	1,000,000	4,200,000	820,000
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	8.6E-03	8.3E-05	0.015	1.5E-04	6,600	69,000	6,100
	pecans, strawberries, pears	0.7	350	acres	8.6E-03	8.3E-05	0.030	2.9E-04	3,300	34,000	3,000
	wheat, soybeans	0.7	1200	acres	8.6E-03	8.3E-05	0.10	1.0E-03	970	10,000	880
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	8.6E-03	8.3E-05	0.043	4.2E-04	2,300	24,000	2,100
	almonds, beans	1.4	350	acres	8.6E-03	8.3E-05	0.060	5.8E-04	1,700	17,000	1,500
	peaches	1.6	350	acres	8.6E-03	8.3E-05	0.069	6.6E-04	1,500	15,000	1,300
	sod farms	15	350	acres	8.6E-03	8.3E-05	0.645	6.2E-03	160	1,600	140
	ornamentals (foliar spray) aerial	0.7	80	acres	8.6E-03	8.3E-05	6.9E-03	6.6E-05	15,000	150,000	13,000
	ornamentals (foliar spray) chemigation	2.8	80	acres	8.6E-03	8.3E-05	0.028	2.7E-04	3,600	38,000	3,300
	ornamentals (soil directed drench) chemigation	37	5	acres	8.6E-03	8.3E-05	0.023	2.2E-04	4,400	46,000	4,000

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	8.6E-03	8.3E-05	3.4E-03	3.3E-05	29,000	300,000	27,000
	strawberries	0.7	80	acres	8.6E-03	8.3E-05	6.9E-03	6.6E-05	15,000	150,000	13,000
	wheat, soybeans	0.7	200	acres	8.6E-03	8.3E-05	0.017	1.7E-04	5,800	60,000	5,300
	grapes	1	80	acres	8.6E-03	8.3E-05	9.8E-03	9.5E-05	10,000	110,000	9,300
	beans	1.4	80	acres	8.6E-03	8.3E-05	0.014	1.3E-04	7,300	75,000	6,600
	sod farms	15	80	acres	8.6E-03	8.3E-05	0.15	1.4E-03	680	7,000	620
	golf course turf	15	40	acres	8.6E-03	8.3E-05	0.074	7.1E-04	1,400	14,000	1,200
	ornamentals (foliar spray)	2.8	80	acres	8.6E-03	8.3E-05	0.028	2.7E-04	3,600	38,000	3,300
	ornamentals (soil drench)	77	5	acres	8.6E-03	8.3E-05	0.047	4.6E-04	2,100	22,000	1,900
(3c) Mixing/Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.7	40	acres	8.6E-03	8.3E-05	3.4E-03	3.3E-05	29,000	300,000	27,000
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	8.6E-03	8.3E-05	4.9E-03	4.7E-05	20,000	210,000	19,000
	almonds	1.4	40	acres	8.6E-03	8.3E-05	6.9E-03	6.6E-05	15,000	150,000	13,000
	peaches	1.6	40	acres	8.6E-03	8.3E-05	7.9E-03	7.6E-05	13,000	130,000	12,000
	ornamentals	2.8	20	acres	8.6E-03	8.3E-05	6.9E-03	6.6E-05	15,000	150,000	13,000
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.8	100	acres	8.6E-03	8.3E-05	0.034	3.3E-04	2,900	30,000	2,700
	ornamental (soil drench)	77	1	acres	8.6E-03	8.3E-05	9.5E-03	9.1E-05	11,000	110,000	9,600
	turf	15	100	acres	8.6E-03	8.3E-05	0.18	1.8E-03	540	5,600	490
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gal-lons	8.6E-03	8.3E-05	1.5E-04	1.4E-06	6.8E+05	7.0E+06	6.2E+05
	cuttings	0.007	100	gal-lons	8.6E-03	8.3E-05	8.6E-05	8.3E-07	1.2E+06	1.2E+07	1.1E+06
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	1.7E-04	3.4E-05	5.2E-03	1.0E-03	19,000	9,500	6,400

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	1.7E-04	3.4E-05	5.2E-03	1.0E-03	19,000	9,500	6,400
	turf	11	40	acres	1.7E-04	3.4E-05	1.1E-03	2.1E-04	94,000	47,000	31,000
		5.4	40	acres	1.7E-04	3.4E-05	5.2E-04	1.0E-04	190,000	95,000	64,000
	sod farms	11	80	acres	1.7E-04	3.4E-05	2.1E-03	4.3E-04	47,000	23,000	16,000
		5.4	80	acres	1.7E-04	3.4E-05	1.0E-03	2.1E-04	95,000	48,000	32,000
(5) Loading Dusts (Exposure studies used for UE values) (l)	peanut seeds	0.047	20	acres	No Data	No Data	See previous tables				
	potato seed pieces	1.2	30	acres			See previous tables				
Applicator											
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	acres	0.005	6.8E-05	8.8E-03	1.2E-04	11,000	84,000	10,000
	pecans, strawberries, pears	0.7	350	acres	0.005	6.8E-05	0.018	2.4E-04	5,700	42,000	5,000
	wheat, soybeans	0.7	1200	acres	0.005	6.8E-05	0.060	8.2E-04	1,700	12,000	1,500
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	0.005	6.8E-05	0.025	3.4E-04	4,000	29,000	3,500
	almonds, beans	1.4	350	acres	0.005	6.8E-05	0.035	4.8E-04	2,900	21,000	2,500
	peaches	1.6	350	acres	0.005	6.8E-05	0.040	5.4E-04	2,500	18,000	2,200
	onions, sod farms	15	350	acres	0.005	6.8E-05	0.375	5.1E-03	270	2,000	230
	ornamentals (foliar spray) aerial	0.7	80	acres	0.005	6.8E-05	4.0E-03	5.4E-05	25,000	180,000	22,000
(7) Applying Granulars Aerially*	ornamentals	27	80	acres	0.0017	0.0013	0.052	0.040	1900	250	250
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	0.005	4.3E-05	2.0E-03	1.7E-05	50,000	580,000	46,000
	strawberries	0.7	80	acres	0.005	4.3E-05	4.0E-03	3.4E-05	25,000	290,000	23,000
	wheat, soybeans	0.7	200	acres	0.005	4.3E-05	0.010	8.6E-05	10,000	120,000	9,200
	grapes, potatoes	1	80	acres	0.005	4.3E-05	5.7E-03	4.9E-05	18,000	200,000	16,000
	beans	1.4	80	acres	0.005	4.3E-05	8.0E-03	6.9E-05	13,000	150,000	12,000
	onions, sod farms	15	80	acres	0.005	4.3E-05	0.086	7.4E-04	1,200	14,000	1,100

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
	golf course turf	15	40	acres	0.005	4.3E-05	0.043	3.7E-04	2,300	27,000	2,100
	ornamentals (foliar spray)	2.8	80	acres	0.005	4.3E-05	0.016	1.4E-04	6,300	73,000	5,800
	ornamentals (soil drench)	77	5	acres	0.005	4.3E-05	0.028	2.4E-04	3,600	42,000	3,300
		37	5	acres	0.005	4.3E-05	0.013	1.1E-04	7,600	88,000	7,000
(9) Applying with an Airblast Sprayer	pecans, pears	0.7	40	acres	0.019	4.5E-04	7.6E-03	1.8E-04	13,000	56,000	11,000
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	0.019	4.5E-04	0.011	2.6E-04	9,200	39,000	7,400
	almonds	1.4	40	acres	0.019	4.5E-04	0.015	3.6E-04	6,600	28,000	5,300
	peaches	1.6	40	acres	0.019	4.5E-04	0.017	4.1E-04	5,800	24,000	4,700
	ornamentals	2.8	20	acres	0.019	4.5E-04	0.015	3.6E-04	6,600	28,000	5,300
(10) Applying with a Handgun Sprayer	ornamentals (foliar spray)	2.8	5	acres	NF	NF	NF	NF	NF	NF	NF
	ornamentals (soil drench) (m)	77	0.05	acres							
	turf	15	5	acres							
(11) Applying Granular Formulations with a Tractor-Drawn Spreader	ornamentals	27	40	acres	0.0021	2.2E-04	0.032	3.4E-03	3,100	2,900	1,500
	turf	11	40	acres	0.0021	2.2E-04	0.013	1.4E-03	7,600	7,200	3,700
		5.4	40	acres	0.0021	2.2E-04	6.5E-03	6.8E-04	15,000	15,000	7,500
(12) Applying Dip Treatment	bulbs	0.012	100	gallons	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	cuttings	0.007	100	gallons							
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (l)	cutting/sorting	1.2	30	acres	No Data	No Data	No Data - see Baseline and PPE assessments				
	planter/operator	1.2	30	acres	0.027	0.0027	0.014	1.4E-03	7,200	7,200	3,600
	planter/observer	1.2	30	acres	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Mixer/Loader/Applicator											

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
(14) Mixing/Loading/ Applying Liquids using High Pressure Handwand	ornamentals (foliar spray)	0.007	1000	gal-lons	NF						
(15) Mixing/Loading/ Applying WP using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	NF						
	turf (o)	15	0.5	acres							
(16) Mixing/Loading/ Applying Liquid Formulations using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	NF						
	turf (o)	15.3	0.5	acres							
(17) Mixing/Loading/ Applying Dry Flowables using Low Pressure Handwand	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	NF						
	turf (o)	15	0.5	acres							
(18) Mixing/loading/ Applying with a Backpack Sprayer	ornamentals (soil drench and foliar spray)	0.007	40	gal-lons	NF						
	turf	15	0.5	acres							
(19a) Mixing/Loading/ Applying Liquid Formulations with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	NF						
	ornamental (soil drench) (m)	77	0.05	acres							
	turf	15	5	acres							

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
(19b) Mixing/Loading/ Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	NF						
	ornamental (soil drench) (m)	37	0.05	acres							
	turf	15	5	acres							
(19c) Mixing/Loading/ Applying Wettable Powders with a Handgun Sprayer (ORETF data)	ornamental (foliar spray)	2.8	5	acres	NF						
	ornamental (soil drench) (m)	77	0.05	acres							
	turf	15	5	acres							
(20) Loading/Applying Granules to Turf using Belly Grinder	ornamentals	27	1	acres	NF						
	turf	11	1	acres							
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data)	ornamentals	27	5	acres	NF						
	lawns, golf courses	11	5	acres							
(22) Loading/Applying Dust as a Seed Treatment (dry) in planter box (n)	peanuts	0.047	20	acres	No Data						

Table 8a: Thiophanate Methyl: Occupational Handler Non-Cancer Exposure and Risk Estimates With Engineering Controls											
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Engineering Controls Dermal UE (mg/lb ai) (c)	Engineering Controls Inhalation UE (mg/lb ai) (d)	Dermal Dose (mg/kg/day) (e)	Inhalation Dose (mg/kg/day) (f)	Dermal MOE (g)	Inhalation MOE (h)	Total MOE (i)
(23) Mixing/Loading/ Applying a Dip Treatment	bulbs	0.012	100	gal-lons	No Data						
	cuttings	0.007	100	gal-lons							
Flagger											
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	0.005	4.3E-05	8.8E-03	7.5E-05	11,000	130,000	11,000
	pecans, pears, strawberries, wheat soybeans	0.7	350	acres	0.005	4.3E-05	0.018	1.5E-04	5,700	66,000	5,300
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	0.005	4.3E-05	0.025	2.2E-04	4,000	47,000	3,700
	almonds, beans	1.4	350	acres	0.005	4.3E-05	0.035	3.0E-04	2,900	33,000	2,600
	peaches	1.6	350	acres	0.005	4.3E-05	0.040	3.4E-04	2,500	29,000	2,300
	onions, sod farms	15	350	acres	0.005	4.3E-05	0.375	3.2E-03	270	3,100	250
	ornamentals (foliar spray)	2.8	80	acres	0.005	4.3E-05	0.016	1.4E-04	6,300	73,000	5,800
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	0.0021	2.2E-04	0.065	6.8E-03	1,500	1,500	750

Footnotes:

a Application rates are the maximum application rates determined from EPA registered labels, except where specific turf and ornamental rates supplied by registrant are also shown.

b Amount handled per day values are based on HED Exposure SAC Policy # 009 "Standard Values for Daily Acres Treated in Agriculture," revised June 23, 2000, or best professional judgment when data is not available. Ornamental acres treated aerially is based on personal communication with ANLA on 12/7/00. Lawn and ornamental rates are explained further in footnotes i-k below.

c Unit Exposure (UE): Unless otherwise noted, dermal unit exposure values from PHED v. 1.1 Surrogate Exposure Guide, August, 1998. Engineering controls represent:
1a,b,c,d,e,f mechanical transfer - closed system mixing/loading
2 and 3 a,b,c,d, e - water soluble bags
4 and 5 - closed mixing and loading ("lock and load") system
6, 7, 8, 9, 11, 13, 24, and 25 - enclosed cab/cockpit
10, 12, 14, 15, 16, 17, 18, 19 a,b,c, 20, 21, 22, 23 - not feasible

d Unless otherwise noted, inhalation unit exposure values from PHED v. 1.1 Surrogate Exposure Guide, August, 1998 for the engineering controls specified in footnote c.

e Dermal dose = dermal unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).

f Inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70 kg).

g Short/Intermediate-term dermal MOE = NOAEL (100 mg/kg/day / daily dermal dose (mg/kg/day).

h Short/Intermediate-term inhalation MOE = NOAEL (10 mg/kg/day / daily inhalation dose (mg/kg/day).

i Short/Intermediate-term total MOE = 1 / 1/dermal MOE) + (1/inhalation MOE).

j Represents support of 20 LCO trucks holding 500 gallons of solution each. These 20 trucks could apply 10,000 gallons of TM solution to 1 acre for a drench treatment.

k Represents support of 20 LCO trucks which can treat 5 acres each.

l Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study). The dermal exposure was adjusted to the use of thiophanate

methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Cancer risk was based on 3-10 planting days per year , assuming USDA estimates of farm size (i.e., 100-300 acres depending on geographic region). Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

m Represents 1 truck holding 500 gallons of TM solution which could treat 0.05 acres (1/20th of an acre which receives 10,000 gallons/acre) as a drench treatment.

n Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

o For turf applications 3336WP label: 2 gals min/1000 sq ft x 40 gal/day estimated rate = 20,000 sq ft or 0.5 acre/day.

ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)

*low confidence data due to insufficient replicates

NF= no feasible controls for this scenario

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
Mixer/Loader													
(1a) Mixing/Loading Wettable Powder for Aerial/ Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	0.0098	2.4E-04	1.6E-03	6.7E-06	6.7E-05	9.2E-08	9.2E-07
	pecans, strawberries, pears	0.6	350	acres	3	30	0.0098	2.4E-04	2.8E-03	1.1E-05	1.1E-04	1.6E-07	1.6E-06
	wheat, soybeans	0.7	1200	acres	3	30	0.0098	2.4E-04	1.1E-02	4.6E-05	4.6E-04	6.3E-07	6.3E-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	0.0098	2.4E-04	4.6E-03	1.9E-05	1.9E-04	2.6E-07	2.6E-06
	almonds, beans	1	350	acres	3	30	0.0098	2.4E-04	4.6E-03	1.9E-05	1.9E-04	2.6E-07	2.6E-06
	peaches	1.3	350	acres	3	30	0.0098	2.4E-04	6.0E-03	2.5E-05	2.5E-04	3.4E-07	3.4E-06
	onions, sod farms	11	350	acres	3	30	0.0098	2.4E-04	5.1E-02	2.1E-04	2.1E-03	2.9E-06	2.9E-05
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	0.0098	2.4E-04	5.3E-04	NA	1.7E-05	NA	2.4E-07
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	0.0098	2.4E-04	2.2E-03	9.1E-06	NA	1.3E-07	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	0.0098	2.4E-04	2.4E-03	1.0E-05	3.0E-05	1.4E-07	4.2E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(1b) Mixing/Loading Wettable Powder for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	0.0098	2.4E-04	3.7E-04	1.5E-06	1.5E-05	2.1E-08	2.1E-07
	strawberries	0.6	80	acres	3	30	0.0098	2.4E-04	6.3E-04	2.6E-06	2.6E-05	3.6E-08	3.6E-07
	wheat, soybeans	0.7	200	acres	3	30	0.0098	2.4E-04	1.9E-03	7.6E-06	7.6E-05	1.1E-07	1.1E-06
	grapes, potatoes	1	80	acres	3	30	0.0098	2.4E-04	1.1E-03	4.3E-06	4.3E-05	6.0E-08	6.0E-07
	beans	1	80	acres	3	30	0.0098	2.4E-04	1.1E-03	4.3E-06	4.3E-05	6.0E-08	6.0E-07
	onions, sod farms	11	80	acres	3	30	0.0098	2.4E-04	1.2E-02	4.8E-05	4.8E-04	6.6E-07	6.6E-06
	golf course turf	11	40	acres	3	9	0.0098	2.4E-04	5.8E-03	2.4E-05	7.2E-05	3.3E-07	9.9E-07
	ornamentals (foliar spray)	2.1	40	acres	3	9	0.0098	2.4E-04	1.1E-03	4.6E-06	1.4E-05	6.3E-08	1.9E-07
	ornamentals (soil drench)	37	5	acres	3	9	0.0098	2.4E-04	2.4E-03	1.0E-05	3.0E-05	1.4E-07	4.2E-07
(1c) Mixing/Loading Wettable Powder for Airblast Application	pecans, pears	0.6	40	acres	3	30	0.0098	2.4E-04	3.2E-04	1.3E-06	1.3E-05	1.8E-08	1.8E-07
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	0.0098	2.4E-04	5.3E-04	2.2E-06	2.2E-05	3.0E-08	3.0E-07
	almonds	1	40	acres	3	30	0.0098	2.4E-04	5.3E-04	2.2E-06	2.2E-05	3.0E-08	3.0E-07
	peaches	1.3	40	acres	3	30	0.0098	2.4E-04	6.9E-04	2.8E-06	2.8E-05	3.9E-08	3.9E-07
	ornamentals	2.1	20	acres	3	30	0.0098	2.4E-04	5.6E-04	2.3E-06	2.3E-05	3.2E-08	3.2E-07
(1d)Mixing/Loading Wettable Powders for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	0.0098	2.4E-04	2.8E-03	1.1E-05	1.1E-04	1.6E-07	1.6E-06

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
	ornamental (soil drench)	37	1	acres	3	30	0.0098	2.4E-04	4.9E-04	2.0E-06	2.0E-05	2.8E-08	2.8E-07
	turf (j)	5.4	100	acres	3	30	0.0098	2.4E-04	7.1E-03	2.9E-05	2.9E-04	4.1E-07	4.1E-06
(1e) Mixing/Loading Wettable Powder for Dip Application	bulbs	0.012	100	gal-lons	3	30	0.0098	2.4E-04	1.6E-05	6.5E-08	6.5E-07	9.0E-10	9.0E-09
	cuttings	0.007	100	gal-lons	3	9	0.0098	2.4E-04	9.3E-06	3.8E-08	1.1E-07	5.3E-10	1.6E-09
(2a) Mixing/Loading Dry Flowable /WDG for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	0.0098	2.4E-04	1.6E-03	6.7E-06	6.7E-05	9.2E-08	9.2E-07
	pecans, strawberries	0.6	350	acres	3	30	0.0098	2.4E-04	2.8E-03	1.1E-05	1.1E-04	1.6E-07	1.6E-06
	wheat, soybeans	0.7	1200	acres	3	30	0.0098	2.4E-04	1.1E-02	4.6E-05	4.6E-04	6.3E-07	6.3E-06
	apples, apricots, cherries, nectarines, plums/prunes	1	350	acres	3	30	0.0098	2.4E-04	4.6E-03	1.9E-05	1.9E-04	2.6E-07	2.6E-06
	almonds, beans	1	350	acres	3	30	0.0098	2.4E-04	4.6E-03	1.9E-05	1.9E-04	2.6E-07	2.6E-06
	peaches	1.3	350	acres	3	30	0.0098	2.4E-04	6.0E-03	2.5E-05	2.5E-04	3.4E-07	3.4E-06
	onions, sod farms	11	350	acres	3	30	0.0098	2.4E-04	5.1E-02	2.1E-04	2.1E-03	2.9E-06	2.9E-05
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	0.0098	2.4E-04	5.3E-04	#VALUE!	1.7E-05	NA	2.4E-07
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	0.0098	2.4E-04	2.2E-03	9.1E-06	#VALUE!	1.3E-07	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	0.0098	2.4E-04	2.4E-03	1.0E-05	3.0E-05	1.4E-07	4.2E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(2b) Mixing/Loading Dry Flowable/WDG for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	0.0098	2.4E-04	3.7E-04	1.5E-06	1.5E-05	2.1E-08	2.1E-07
	strawberries	0.6	80	acres	3	30	0.0098	2.4E-04	6.3E-04	2.6E-06	2.6E-05	3.6E-08	3.6E-07
	wheat, soybeans	0.7	200	acres	3	30	0.0098	2.4E-04	1.9E-03	7.6E-06	7.6E-05	1.1E-07	1.1E-06
	beans	1	80	acres	3	30	0.0098	2.4E-04	1.1E-03	4.3E-06	4.3E-05	6.0E-08	6.0E-07
	onions, sod farms	11	80	acres	3	30	0.0098	2.4E-04	1.2E-02	4.8E-05	4.8E-04	6.6E-07	6.6E-06
	golf course turf	11	40	acres	3	9	0.0098	2.4E-04	5.8E-03	2.4E-05	7.2E-05	3.3E-07	9.9E-07
	ornamentals (foliar spray)	2.1	80	acres	3	9	0.0098	2.4E-04	2.2E-03	9.1E-06	2.7E-05	1.3E-07	3.8E-07
	ornamentals (soil drench)	37	5	acres	3	9	0.0098	2.4E-04	2.4E-03	1.0E-05	3.0E-05	1.4E-07	4.2E-07
(2c) Mixing/Loading Dry Flowable/WDG for Airblast Application	pecans	0.6	40	acres	3	30	0.0098	2.4E-04	3.2E-04	1.3E-06	1.3E-05	1.8E-08	1.8E-07
	apples, apricots, cherries, plums/prunes, nectarines	1	40	acres	3	30	0.0098	2.4E-04	5.3E-04	2.2E-06	2.2E-05	3.0E-08	3.0E-07
	almonds	1	40	acres	3	30	0.0098	2.4E-04	5.3E-04	2.2E-06	2.2E-05	3.0E-08	3.0E-07
	peaches	1.3	40	acres	3	30	0.0098	2.4E-04	6.9E-04	2.8E-06	2.8E-05	3.9E-08	3.9E-07
	ornamentals	2.1	20	acres	3	30	0.0098	2.4E-04	5.6E-04	2.3E-06	2.3E-05	3.2E-08	3.2E-07
(2d) Mixing/Loading Dry Flowable /WDG for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	0.0098	2.4E-04	2.8E-03	1.1E-05	1.1E-04	1.6E-07	1.6E-06
	ornamental (soil drench)	37	1	acres	3	30	0.0098	2.4E-04	4.9E-04	2.0E-06	2.0E-05	2.8E-08	2.8E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
	lawns (j)	5.4	100	acres	3	30	0.0098	2.4E-04	7.1E-03	2.9E-05	2.9E-04	4.1E-07	4.1E-06
(2e) Mixing/Loading Dry Flowable/WDG for Dip Application	bulbs	0.012	100	gallons	3	30	0.0098	2.4E-04	1.6E-05	6.5E-08	6.5E-07	9.0E-10	9.0E-09
	cuttings	0.007	100	gallons	3	9	0.0098	2.4E-04	9.3E-06	3.8E-08	1.1E-07	5.3E-10	1.6E-09
(3a) Mixing/Loading Liquid Flowable Concentrates for Aerial/Chemigation Application	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	0.0086	8.3E-05	1.2E-03	4.9E-06	4.9E-05	6.8E-08	6.8E-07
	pecans, strawberries, pears	0.6	350	acres	3	30	0.0086	8.3E-05	2.1E-03	8.4E-06	8.4E-05	1.2E-07	1.2E-06
	wheat, soybeans	0.7	1200	acres	3	30	0.0086	8.3E-05	8.2E-03	3.4E-05	3.4E-04	4.7E-07	4.7E-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	350	acres	3	30	0.0086	8.3E-05	3.4E-03	1.4E-05	1.4E-04	1.9E-07	1.9E-06
	almonds, beans	1	350	acres	3	30	0.0086	8.3E-05	3.4E-03	1.4E-05	1.4E-04	1.9E-07	1.9E-06
	peaches	1.3	350	acres	3	30	0.0086	8.3E-05	4.5E-03	1.8E-05	1.8E-04	2.5E-07	2.5E-06
	sod farms	11	350	acres	3	30	0.0086	8.3E-05	3.8E-02	1.5E-04	1.5E-03	2.1E-06	2.1E-05
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	0.0086	8.3E-05	3.9E-04	NA	1.3E-05	NA	1.8E-07
	ornamentals (foliar spray) chemigation	2.1	80	acres	3	NA	0.0086	8.3E-05	1.6E-03	6.8E-06	NA	9.3E-08	NA
	ornamentals (soil directed drench) chemigation	37	5	acres	3	9	0.0086	8.3E-05	1.8E-03	7.4E-06	2.2E-05	1.0E-07	3.1E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(3b) Mixing/Loading of Liquid Flowable Concentrates for Groundboom Application	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	0.0086	8.3E-05	2.7E-04	1.1E-06	1.1E-05	1.6E-08	1.6E-07
	strawberries	0.6	80	acres	3	30	0.0086	8.3E-05	4.7E-04	1.9E-06	1.9E-05	2.7E-08	2.7E-07
	wheat, soybeans	0.7	200	acres	3	30	0.0086	8.3E-05	1.4E-03	5.6E-06	5.6E-05	7.8E-08	7.8E-07
	grapes	1	80	acres	3	30	0.0086	8.3E-05	7.8E-04	3.2E-06	3.2E-05	4.4E-08	4.4E-07
	beans	1	80	acres	3	30	0.0086	8.3E-05	7.8E-04	3.2E-06	3.2E-05	4.4E-08	4.4E-07
	sod farms	11	80	acres	3	30	0.0086	8.3E-05	8.6E-03	3.5E-05	3.5E-04	4.9E-07	4.9E-06
	golf course turf	11	40	acres	3	9	0.0086	8.3E-05	4.3E-03	1.8E-05	5.3E-05	2.4E-07	7.3E-07
	ornamentals (foliar spray)	2.1	80	acres	3	9	0.0086	8.3E-05	1.6E-03	6.8E-06	2.0E-05	9.3E-08	2.8E-07
	ornamentals (soil drench)	37	5	acres	3	9	0.0086	8.3E-05	1.8E-03	7.4E-06	2.2E-05	1.0E-07	3.1E-07
(3c) Mixing/Loading of Liquid Flowable Concentrates for Airblast Application	pecans, pears	0.6	40	acres	3	30	0.0086	8.3E-05	2.3E-04	9.7E-07	9.7E-06	1.3E-08	1.3E-07
	apples, apricots, cherries, plums/prunes, nectarines, grapes	1	40	acres	3	30	0.0086	8.3E-05	3.9E-04	1.6E-06	1.6E-05	2.2E-08	2.2E-07
	almonds	1	40	acres	3	30	0.0086	8.3E-05	3.9E-04	1.6E-06	1.6E-05	2.2E-08	2.2E-07
	peaches	1.3	40	acres	3	30	0.0086	8.3E-05	5.1E-04	2.1E-06	2.1E-05	2.9E-08	2.9E-07
	ornamentals	2.1	20	acres	3	30	0.0086	8.3E-05	4.1E-04	1.7E-06	1.7E-05	2.3E-08	2.3E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(3d) Mixing/Loading Liquid Flowable Concentrates for Lawn Handgun Application	ornamental (foliar spray)	2.1	100	acres	3	30	0.0086	8.3E-05	2.1E-03	8.4E-06	8.4E-05	1.2E-07	1.2E-06
	ornamental (soil drench)	37	1	acres	3	30	0.0086	8.3E-05	3.6E-04	1.5E-06	1.5E-05	2.1E-08	2.1E-07
	turf (j)	5.4	100	acres	3	30	0.0086	8.3E-05	5.3E-03	2.2E-05	2.2E-04	3.0E-07	3.0E-06
(3e) Mixing/Loading Liquid Flowable Concentrates for Dip Application	bulbs	0.012	100	gallons	3	30	0.0086	8.3E-05	1.2E-05	4.8E-08	4.8E-07	6.7E-10	6.7E-09
	cuttings	0.007	100	gallons	3	9	0.0086	8.3E-05	6.9E-06	2.8E-08	8.4E-08	3.9E-10	1.2E-09
(4a) Loading Granular Formulations for Aerial Application	ornamentals	27	80	acres	NA	24	0.00017	3.4E-05	1.4E-03	NA	4.7E-05	NA	6.4E-07
(4b) Loading Granular Formulation For Mechanical Ground Application	ornamentals	27	80	acres	3	30	0.00017	3.4E-05	1.4E-03	5.8E-06	5.8E-05	8.0E-08	8.0E-07
	turf	11	40	acres	3	9	0.00017	3.4E-05	2.9E-04	1.2E-06	3.6E-06	1.6E-08	4.9E-08
		5.4 (typical)	40	acres	3	9	0.00017	3.4E-05	1.4E-04	5.8E-07	1.7E-06	8.0E-09	2.4E-08
	sod farms	11	80	acres	3	30	0.00017	3.4E-05	5.8E-04	2.4E-06	2.4E-05	3.3E-08	3.3E-07
		5.4 (typical)	80	acres	3	30	0.00017	3.4E-05	2.8E-04	1.2E-06	1.2E-05	1.6E-08	1.6E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(5) Loading Dusts (Exposure studies used for Unit Exposure values)	peanut seeds	0.047	20	acres	3	10	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	potato seed pieces	1.2	30	acres	3	10	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Applicator													
(6) Applying Sprays Aerially	cucurbits, peanuts, sugar beets	0.35	350	acres	NA	30	0.005	6.8E-05	7.3E-04	NA	3.0E-05	NA	4.1E-07
	pecans, strawberries, pears	0.6	350	acres	NA	30	0.005	6.8E-05	1.3E-03	NA	5.2E-05	NA	7.1E-07
	wheat, soybeans	0.7	1200	acres	NA	30	0.005	6.8E-05	5.0E-03	NA	2.1E-04	NA	2.8E-06
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	NA	30	0.005	6.8E-05	2.1E-03	NA	8.6E-05	NA	1.2E-06
	almonds, beans	1	350	acres	NA	30	0.005	6.8E-05	2.1E-03	NA	8.6E-05	NA	1.2E-06
	peaches	1.3	350	acres	NA	30	0.005	6.8E-05	2.7E-03	NA	1.1E-04	NA	1.5E-06
	onions, sod farms	11	350	acres	NA	30	0.005	6.8E-05	2.3E-02	NA	9.4E-04	NA	1.3E-05
	ornamentals (foliar spray) aerial	0.5	80	acres	NA	24	0.005	6.8E-05	2.4E-04	NA	7.9E-06	NA	1.1E-07
(7) Applying Granulars Aerially	ornamentals	27	80	acres	NA	30	0.0017	0.0013	0.044	NA	1.8E-03	NA	2.5E-05
(8) Applying with Groundboom	cucurbits, peanuts, sugar beets	0.35	80	acres	3	30	0.005	4.3E-05	1.6E-04	6.5E-07	6.5E-06	8.9E-09	8.9E-08
	strawberries	0.6	80	acres	3	30	0.005	4.3E-05	2.7E-04	1.1E-06	1.1E-05	1.5E-08	1.5E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls														
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)	
	wheat, soybeans	0.7	200	acres	3	30	0.005	4.3E-05	7.9E-04	3.2E-06	3.2E-05	4.5E-08	4.5E-07	
	grapes, potatoes	1	80	acres	3	30	0.005	4.3E-05	4.5E-04	1.8E-06	1.8E-05	2.5E-08	2.5E-07	
	beans	1	80	acres	3	30	0.005	4.3E-05	4.5E-04	1.8E-06	1.8E-05	2.5E-08	2.5E-07	
	onions, sod farms	11	80	acres	3	30	0.005	4.3E-05	4.9E-03	2.0E-05	2.0E-04	2.8E-07	2.8E-06	
	golf course turf	11	40	acres	3	30	0.005	4.3E-05	2.5E-03	1.0E-05	1.0E-04	1.4E-07	1.4E-06	
	ornamentals (foliar spray)	2.1	80	acres	3	9	0.005	4.3E-05	9.4E-04	3.9E-06	1.2E-05	5.3E-08	1.6E-07	
	ornamentals (soil drench)	37	5	acres	3	9	0.005	4.3E-05	1.0E-03	4.3E-06	1.3E-05	5.9E-08	1.8E-07	
(9) Applying with an Airblast Sprayer	pecans, pears	0.6	40	acres	3	30	0.019	4.5E-04	6.1E-04	2.5E-06	2.5E-05	3.5E-08	3.5E-07	
	apples, apricots, cherries, plums/prunes, nectarines, grapes, potatoes	1	40	acres	3	30	0.019	4.5E-04	1.0E-03	4.2E-06	4.2E-05	5.8E-08	5.8E-07	
	almonds	1	40	acres	3	30	0.019	4.5E-04	1.0E-03	4.2E-06	4.2E-05	5.8E-08	5.8E-07	
	peaches	1.3	40	acres	3	30	0.019	4.5E-04	1.3E-03	5.4E-06	5.4E-05	7.5E-08	7.5E-07	
	ornamentals	2.1	20	acres	3	30	0.019	4.5E-04	1.1E-03	4.4E-06	4.4E-05	6.1E-08	6.1E-07	
(10) Applying with a Handgun Sprayer (ORETF Data)	all crops						NF							
(11) Applying Granulars with Tractor-Drawn Spreader	ornamentals	27	40	acres	3	30	0.0021	2.2E-04	5.7E-03	2.3E-05	2.3E-04	3.2E-07	3.2E-06	
	turf	5.4	40	acres	3	30	0.0021	2.2E-04	1.1E-03	4.7E-06	4.7E-05	6.4E-08	6.4E-07	
(12) Applying Dip Treatment	bulbs	0.012	100	gallons	3	30	No Data							
	cuttings	0.007	100	gallons	3	9								

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
(13) Applying Dust as a Potato Seed Treatment (Exposure study Stevens/Davis, 1981) (k)	cutting/sorting	1.2	30	acres	3	10	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	planter/operator	1.2	30	acres	3	10	0.027	2.7E-03	2.4E-03	9.7E-06	3.2E-05	1.3E-07	4.5E-07
	planter/observer	1.2	30	acres	3	10	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Mixer/Loader/Applicator													
(14) Mixing/Loading/Applying Liquids using High Pressure Handwand all crops							NF						
(15) Mixing/Loading/Applying WP using Low Pressure Handwand all crops							NF						
(16) Mixing/Loading/Applying Liquid Formulations using Low Pressure Handwand all crops							NF						
(17) Mixing/Loading/Applying Dry Flowables using Low Pressure Handwand all crops							NF						
(18) Mixing/loading/Applying with a Backpack Sprayer all crops							NF						
(19a) Mixing/Loading/Applying Liquids with a Handgun Sprayer (ORETF data) all crops							NF						
(19b) Mixing/Loading/Applying Dry Flowables (WDG) with a Handgun Sprayer (ORETF data) all crops							NF						
(19c) Mixing/Loading/Applying Wettable Powder Formulations with a Handgun Sprayer (ORETF data) all crops							NF						
(20) Loading/Applying Granules to Turf using Belly Grinder all crops							NF						
(21) Loading/Applying Granules to Turf using Push-Type Spreader (ORETF data) all crops							NF						
(22) Mixing/Loading/Applying Dust as a Seed Treatment (dry) in planter box (Fenske et al., 1990 used for unit exposure value) (l)							No Data						
(23) Mixing/Loading/Applying a Dip Treatment [bulbs, cuttings]							No Data						
Flagger													
(24) Flagging Aerial Spray Applications	cucurbits, peanuts, sugar beets	0.35	350	acres	3	30	5.0E-03	4.3E-05	6.9E-04	2.8E-06	2.8E-05	3.9E-08	3.9E-07
	pecans, pears, strawberries	0.6	350	acres	3	30	5.0E-03	4.3E-05	1.2E-03	4.8E-06	4.8E-05	6.7E-08	6.7E-07
	wheat, soybeans	0.7	350	acres	3	30	5.0E-03	4.3E-05	1.4E-03	5.7E-06	5.7E-05	7.8E-08	7.8E-07

Table 8b: Thiophanate-methyl: Occupational Handler Cancer Risk Estimates using Engineering Controls													
Exposure Scenario	Crop Type/Use	Application Rate (lb ai/acre or lb ai/gallon) (a)	Acreage or other Daily Unit (b)	Units	Private Applicator Treatments / Yr (c)	Commercial Applicator Treatments / Yr (d)	Engineering Controls Dermal Unit Exposure (mg/lb ai) (e)	Engineering Controls Inhalation Unit Exposure (mg/lb ai) (f)	Daily Total Dose (mg/kg/day) Rounded (g)	Private Applicator Total LADD (mg/kg/day) (h)	Commercial Applicator Total LADD (mg/kg/day) (h)	Private Applicator Cancer Risk (i)	Commercial Applicator Cancer Risk (i)
	apples, apricots, cherries, nectarines, plums/prunes, grapes, potatoes	1	350	acres	3	30	5.0E-03	4.3E-05	0.002	8.1E-06	8.1E-05	1.1E-07	1.1E-06
	almonds, beans	1	350	acres	3	30	5.0E-03	4.3E-05	0.002	8.1E-06	8.1E-05	1.1E-07	1.1E-06
	peaches	1.3	350	acres	3	30	5.0E-03	4.3E-05	0.0026	1.0E-05	1.0E-04	1.4E-07	1.4E-06
	onions, sod farms	11	350	acres	3	30	5.0E-03	4.3E-05	0.022	8.9E-05	8.9E-04	1.2E-06	1.2E-05
	ornamentals (foliar spray)	2.1	80	acres	3	24	5.0E-03	4.3E-05	0.00094	3.9E-06	3.1E-05	5.3E-08	4.3E-07
(25) Flagging Aerial Granular Applications	ornamentals	27	80	acres	3	24	2.1E-03	2.2E-04	0.011	4.7E-05	3.7E-04	6.4E-07	5.1E-06

Footnotes:

a Application rates used were "typical rates" where available from BEAD surveys or information provided by the registrants. Where such information was not available, maximum application rates were determined from EPA registered labels.

b Typical application rate (used in the cancer risk estimates) were determined from EPA registered labels when a range of application rates was specified, or from information supplied by the registrant. Maximum application rate was used as a surrogate for typical rate when no other information was available Represents support of 20 LCO trucks holding 500 gallons of solution each. These 20 trucks could apply 10,000 gallons of TM solution to 1 acre for a drench treatment.

c Private applicator treatments per year are based on treatments to an individual site (e.g., farm, nursery, golf course) and represents number of days per year of expected exposure. Best professional judgment and BEAD data were used in determining treatment day estimates (e.g., facility or farm size / acres per day in footnote b = exposure days / year).

d Commercial applicator treatments per year are based on treatment of multiple sites or farms and represents number of days per year of expected exposure.

e Unless otherwise footnoted dermal unit exposure values from PHED v. 1.1 Surrogate Exposure Guide, August, 1998. (see Assumptions Table 23). Engineering controls represent:
1a,b,c,d,e,f mechanical transfer - closed system mixing/loading
2 and 3 a,b,c,d, e - water soluble bags
4 and 5 - closed mixing and loading ("lock and load") system
6, 7, 8, 9, 11, 13, 24, and 25 - enclosed cab/cockpit
10, 12, 14, 15, 16, 17, 18, 19 a,b,c, 20, 21, 22, 23 - not feasible

f Unless otherwise noted, inhalation unit exposure values from PHED v. 1.1 Surrogate Exposure Guide, August, 1998 for the engineering controls specified in footnote c.

g Total ADD (mg/kg/day) = absorbed daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day) where absorbed daily dermal dose = dermal unit exposure (mg/lb ai) x typical application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) x dermal absorption factor (7%) / body weight (70 kg adult), and inhalation dose = inhalation unit exposure (mg/lb ai) x application rate (lb ai/acre or gallons/day) x amount handled per day (acres or gallons/day) / body weight (70).

h Total LADD (mg/kg/day) = ADD (mg/kg/day) x treatment days per year (for private or commercial as appropriate) / 365 days/year x 35 years worked / 70 year lifetime.

i Cancer Risk = Total LADD (mg/kg/day) x Q_1*. Where Q_1* is 0.0138 mg/kg/day^{-1}.

j Represents support of 20 LCO trucks which can treat 5 acres each.

k Exposure data for dust applications based on an exposure study by Stevens and Davis, 1981 (i.e., Captan treated potato seed piece and potato planting study) . The dermal exposure was adjusted to the use of thiophanate methyl 2.5% dust at 0.025 lb/100 lb seed potatoes (TOPS 2.5D Reg No. 7501-32). It was estimated that 30 acres could be treated in an 8 hour day, based on tractor speed, capacity, and lbs seed/acre. Exposure values from the study (mg/hr) were ÷ 4.5 lb ai/hr , in order to determine a standard unit exposure values (mg/lb ai), assuming 30 acres treated /day x 1.2 lb ai/acre ÷ 8 hrs worked/day.

l Unit exposure values based on a Lindane study of peanut treated seed, Fenske et al., 1990.

ORETF Data = Unit exposure values from Outdoor Residential Exposure Task Force studies (MRID 449722-01)

NA = not applicable

NF = No feasible engineering controls for this scenario

Table 9: Thiophanate-methyl: Summary of Postapplication Dislodgeable Residue Studies

MRID 4487630-01 Thiophanate Wettable Powder Apple Leaf Application Study Rate: 1.05 lb ai/A Slope (NY): -0.181869 Intercept (NY): 0.991357 R^2 (NY): 0.94 WA: actual residues values				**MRID 450007-01** TTRr on Turf Treated with 3336 WP Thiophenate Methyl (50%) Study Rate: 19 lb ai/acre (PA); 22 lb ai/acre (avg CA/GA) Slope (PA): -0.17103 Intercept: 0.558107 R^2 (PA): 0.42 Slope (CA/GA): -0.45908 Intercept: 0.621559 R^2 (CA/GA): 0.92			**MRID 448662-01** Dislodgeable Foliar Residues of Topsin M on Strawberries Study Rate: 0.72 lb ai/acre Slope: -0.430026 Intercept: 0.872957 R^2: 0.94		**MRID 450275-01** Dissipation of Dislodgeable Residues of 3336 WP from Cut Flowers Study Rate: 1.1 lb ai/acre Slope: -0.03903772606520 Intercept: 1.5735277745875 R^2:0.97	
DAT NY (days)	NY DFR (ug/cm2) predicted	DAT WA (days)	WA DFR (ug/cm2) actual residues	DAT (days)	Avg CA/GA TTR ug/cm2 predicted	PA TTR (ug/cm2) predicted	DAT (days)	Avg CA/NC DFR (ug/cm2) predicted	DAT (days)	Avg Roses and Mums DFR (ug/cm2) predicted
0	3.140	0	2.270	0	1.862	1.75	0	2.39	0	4.82
1	2.598	1	2.270	1	1.176	1.48	1	1.56	1	4.64
2	2.149	3	2.530	2	0.743	1.24	2	1.01	2	4.46
3	1.778	5	2.430	3	0.470	1.05	3	0.659	3	4.29
4	1.471	7	1.970	4	0.297	0.883	4	0.429	4	4.13
5	1.217	14	1.290	5	0.188	0.744	5	0.279	5	3.97
6	1.007	21	1.180	6	0.118	0.627	6	0.181	6	3.82
7	0.833	28	0.793	7	0.075	0.529	7	0.118	7	3.67
8	0.690	42	0.673	8	0.047	0.446	8	0.077	8	3.53
9	0.570	56	0.573	9	0.030	0.376	9	0.050	9	3.39
10	0.472	70	0.497	10	0.019	0.317	10	0.032	10	3.26
11	0.391	84	0.447	11	0.012	0.267	11	0.021	11	3.14
12	0.323			12	7.5E-03	0.225	12	0.0137	12	3.02
13	0.267			13	4.8E-03	0.189	13	8.9E-03	13	2.90
14	0.221			14	3.0E-03	0.160	14	5.8E-03	14	2.79

Table 9: Thiophanate-methyl: Summary of Postapplication Dislodgeable Residue Studies

MRID 4487630-01 Thiophanate Wettable Powder Apple Leaf Application Study Rate: 1.05 lb ai/A Slope (NY): -0.181869 Intercept (NY): 0.991357 R^2 (NY): 0.94 WA: actual residues values				**MRID 450007-01** TTRr on Turf Treated with 3336 WP Thiophenate Methyl (50%) Study Rate: 19 lb ai/acre (PA); 22 lb ai/acre (avg CA/GA) Slope (PA): -0.17103 Intercept: 0.558107 R^2 (PA): 0.42 Slope (CA/GA): -0.45908 Intercept: 0.621559 R^2 (CA/GA): 0.92			**MRID 448662-01** Dislodgeable Foliar Residues of Topsin M on Strawberries Study Rate: 0.72 lb ai/acre Slope: -0.430026 Intercept: 0.872957 R^2: 0.94		**MRID 450275-01** Dissipation of Dislodgeable Residues of 3336 WP from Cut Flowers Study Rate: 1.1 lb ai/acre Slope: -0.03903772606520 Intercept: 1.5735277745875 R^2:0.97	
DAT NY (days)	NY DFR (ug/cm2) predicted	DAT WA (days)	WA DFR (ug/cm2) actual residues	DAT (days)	Avg CA/GA TTR ug/cm2 predicted	PA TTR (ug/cm2) predicted	DAT (days)	Avg CA/NC DFR (ug/cm2) predicted	DAT (days)	Avg Roses and Mums DFR (ug/cm2) predicted
15	0.183			15	1.9E-03	0.135	15	3.8E-03	15	2.69
16	0.151			16	1.2E-03	0.113	16	2.5E-03	16	2.58
17	0.125			17	7.6E-04	0.096	17	1.6E-03	17	2.48
18	0.104			18	4.8E-04	0.081	18	1.0E-03	18	2.39
19	0.086			19	3.0E-04	0.068	19	6.8E-04	19	2.30
20	0.071			20	1.9E-04	0.057	20	4.4E-04	20	2.21
21	0.059			21	1.2E-04	0.048			21	2.12
27	0.019			27	8.0E-06	0.017			120	0.0445
28	0.016			28	5.0E-06	0.015			135	0.0248
29	0.013			29	3.0E-06	0.012			155	0.0114
30	0.011			30	2.0E-06	0.010			170	0.0063
Average: DAT 1-14	**0.999**	**Average: DAT 1-14**	**2.098**	Average: DAT 1-14	**0.228**	**0.609**	Average: DAT 1-14	**0.317**	Average: DAT 1-14	**3.64**
Average: DAT 2-14	**0.876**	**DAT 3-14**	**2.055**	Average: DAT 2-14	**0.155**	**0.543**	Average: DAT 2-14	**0.222**	Average: DAT 2-14	**3.57**
Average: DAT 3-14	**0.770**	**DAT 5-14**	**1.897**	Average: DAT 3-14	**0.106**	**0.484**	Average: DAT 3-14	**0.156**	Average: DAT 3-14	**3.49**

Table 9: Thiophanate-methyl: Summary of Postapplication Dislodgeable Residue Studies

MRID 4487630-01 Thiophanate Wettable Powder Apple Leaf Application Study Rate: 1.05 lb ai/A Slope (NY): -0.181869 Intercept (NY): 0.991357 R^2 (NY): 0.94 WA: actual residues values				**MRID 450007-01** TTRr on Turf Treated with 3336 WP Thiophenate Methyl (50%) Study Rate: 19 lb ai/acre (PA); 22 lb ai/acre (avg CA/GA) Slope (PA): -0.17103 Intercept: 0.558107 R^2 (PA): 0.42 Slope (CA/GA): -0.45908 Intercept: 0.621559 R^2 (CA/GA): 0.92			**MRID 448662-01** Dislodgeable Foliar Residues of Topsin M on Strawberries Study Rate: 0.72 lb ai/acre Slope: -0.430026 Intercept: 0.872957 R^2: 0.94		**MRID 450275-01** Dissipation of Dislodgeable Residues of 3336 WP from Cut Flowers Study Rate: 1.1 lb ai/acre Slope: -0.03903772606520 Intercept: 1.5735277745875 R^2:0.97	
DAT NY (days)	NY DFR (ug/cm2) predicted	DAT WA (days)	WA DFR (ug/cm2) actual residues	DAT (days)	Avg CA/GA TTR ug/cm2 predicted	PA TTR (ug/cm2) predicted	DAT (days)	Avg CA/NC DFR (ug/cm2) predicted	DAT (days)	Avg Roses and Mums DFR (ug/cm2) predicted
Average: DAT 4-14	**0.678**	**DAT 7-14**	**1.630**	Average: DAT 4-14	**0.073**	**0.433**	Average: DAT 4-14	**0.111**	Average: DAT 4-14	**3.42**
Average: DAT 5-14	**0.599**			Average: DAT 5-14	**0.050**	**0.388**	Average: DAT 5-14	**0.079**	Average: DAT 5-14	**3.35**
Average: DAT 6-14	**0.530**			Average: DAT 6-14	**0.035**	**0.348**	Average: DAT 6-14	**0.056**	Average: DAT 6-14	**3.28**
Average: DAT 7-14	**0.471**			Average: DAT 7-14	**0.025**	**0.314**	Average: DAT 7-14	**0.041**	Average: DAT 7-14	**3.21**
Average: DAT 8-14	**0.419**			Average: DAT 8-14	**0.018**	**0.283**	Average: DAT 8-14	**0.030**	Average: DAT 8-14	**3.15**
Average: DAT 9-14	**0.374**			Average: DAT 9-14	**0.013**	**0.256**	Average: DAT 9-14	**0.022**	Average: DAT 9-14	**3.09**
Average: DAT 10-14	**0.335**			Average: DAT 10-14	**0.009**	**0.232**	Average: DAT 10-14	**0.016**	Average: DAT 10-14	**3.02**
Average: DAT 11-14	**0.301**			Average: DAT 11-14	**0.007**	**0.210**	Average: DAT 11-14	**0.012**	Average: DAT 11-14	**2.96**

Table 9: Thiophanate-methyl: Summary of Postapplication Dislodgeable Residue Studies

MRID 4487630-01 Thiophanate Wettable Powder Apple Leaf Application Study Rate: 1.05 lb ai/A Slope (NY): -0.181869 Intercept (NY): 0.991357 R^2 (NY): 0.94 WA: actual residues values				**MRID 450007-01** TTRr on Turf Treated with 3336 WP Thiophenate Methyl (50%) Study Rate: 19 lb ai/acre (PA); 22 lb ai/acre (avg CA/GA) Slope (PA): -0.17103 Intercept: 0.558107 R^2 (PA): 0.42 Slope (CA/GA): -0.45908 Intercept: 0.621559 R^2 (CA/GA): 0.92			**MRID 448662-01** Dislodgeable Foliar Residues of Topsin M on Strawberries Study Rate: 0.72 lb ai/acre Slope: -0.430026 Intercept: 0.872957 R^2: 0.94		**MRID 450275-01** Dissipation of Dislodgeable Residues of 3336 WP from Cut Flowers Study Rate: 1.1 lb ai/acre Slope: -0.03903772606520 Intercept: 1.5735277745875 R^2:0.97	
DAT NY (days)	NY DFR (ug/cm2) predicted	DAT WA (days)	WA DFR (ug/cm2) actual residues	DAT (days)	Avg CA/GA TTR ug/cm2 predicted	PA TTR (ug/cm2) predicted	DAT (days)	Avg CA/NC DFR (ug/cm2) predicted	DAT (days)	Avg Roses and Mums DFR (ug/cm2) predicted
Average: DAT 12-14	**0.270**			Average: DAT 12-14	**0.005**	**0.191**	Average: DAT 12-14	**9.50E-03**	Average: DAT 12-14	**2.91**

Table 10: Thiophanate-methyl: Summary of Postapplication Occupational Short/Intermediate Term and Cancer Risks by Crop and Activity						
Crop Treated (Potential for Dermal Contact)	Transfer Coefficient (cm^2/hr) (a)	Activities	REIs MOE>100 (DAT)	MOE at DAT 1	Exposure Duration (Days/Year)	Cancer Risk Estimate Avg DAT 1-14 (b)
Risk Estimates Using Apple DFR Study Data EPA MRID 44876301						
Apples; Cherries, nectarines, apricots, plums/prunes	8000	Thinning	NY: 6 WA: 28	NY: 42 WA: 48		
	3000	Hand pruning, propping, hand harvesting	NY: 1 WA: 0	NY: 110 WA: 130	apple: 60	2.6 E-05 to 5.7E-05
					cherries: 45	2.0E-05 to 4.3E-05
Peaches	8000	Thinning	NY: 8 WA: 56	NY: 28 WA: 32		
	3000	Hand pruning, propping, hand harvesting	NY: 3 WA: 14	NY: 74 WA: 84	45	2.7E-05 to 5.6E-05
Almonds	2500	Hand harvesting, hand pruning	NY: 1 WA: 0	NY: 100 WA: 120	60	2.3E-05 to 4.8E-05
Pecans	2500	Hand harvesting, hand pruning	NY: 0 WA: 0	NY: 170 WA: 230	60	1.4E-05 to 2.9E-05
Pears	8000	Thinning	NY: 4 WA: 14	NY: 63 WA: 72		
	3000	Harvesting, pruning, training, tying	NY: 0 WA: 0	NY: 140 WA: 190	60	1.6E-05 to 3.4E-05
Grapes	10,000	Grape girdling and cane turning	NY: 7 WA: 28	NY: 34 WA: 39		
	5000	Hand harvesting, leaf pulling, thinning, pruning, training/tying	NY: 4 WA: 14	NY: 67 WA: 77	105	7.9E-05 to 1.7E-04
Woody Ornamentals	8000	Hand harvesting, pruning, pinching, and transplanting	NY: 11 WA: >84	NY: 16 WA: 18	30	1.1E-04 to 1.6E-04
Risk Estimates Using Cut Flower DFR Study: Average of Rose & Mum Data EPA MRID 45027501.						

Table 10: Thiophanate-methyl: Summary of Postapplication Occupational Short/Intermediate Term and Cancer Risks by Crop and Activity						
Crop Treated (Potential for Dermal Contact)	Transfer Coefficient (cm^2/hr) (a)	Activities	REIs MOE>100 (DAT)	MOE at DAT 1	Exposure Duration (Days/Year)	Cancer Risk Estimate Avg DAT 1-14 (b)
Cut Flowers	4500 [Brouwer, et al.]	Typical greenhouse activities such as pruning, thinning, harvesting, scouting, irrigating	48	18	90	4.3E-04
Herbaceous Ornamentals	7000	Hand harvesting, pruning, pinching, thinning	59	11		
	4000	Irrigating, scouting	45	19	90	3.8E-04
	2500	Hand weeding	33	30		
Risk Estimates Using Strawberry DFR Study Data EPA MRID 44866201						
Strawberries	1500	Hand harvest, pinch, prune, train	0	240	180	1.1E-05
	400	Irrigate, scout, weed	0	910		
Wheat	1500	Irrigate, scout	0	240	15	1.1E-06
Cucurbits	2500	hand harvest, prune, leaf pulling	0	290	60	3.6E-06
	1500	Hand weed, scout, irrigate	0	490		
Sugar beets	1500	Irrigate, scout	0	490	30	1.1E-06
Soybeans	1500	Irrigate, scout	0	240	45	3.2E-06
Beans	2500	Hand harvest	1	110	45	7.7E-06
	1500	Irrigate, scout	0	120		
Potatoes	2500	Hand harvest	0	100	45	7.7E-06
Potatoes	1500	Irrigate, scout mature plants	0	170		
Herbaceous Ornamentals	7000	Hand harvest, prune, thin, transplant	3	13	120	1.2E-04
	1500	Scout, irrigate	1	260		
Risk Estimates Using Turf TTR Study Data EPA MRID 45000701						

Table 10: Thiophanate-methyl: Summary of Postapplication Occupational Short/Intermediate Term and Cancer Risks by Crop and Activity						
Crop Treated (Potential for Dermal Contact)	Transfer Coefficient (cm^2/hr) (a)	Activities	REIs MOE>100 (DAT)	MOE at DAT 1	Exposure Duration (Days/Year)	Cancer Risk Estimate Avg DAT 1-14 (b)
Turf: Sod farm	16,500	Hand harvest, transplant, weed	Irrig: 2 Dry: 7	Irrig: 66 Dry: 46	90	1.3E-05 to 3.9E-05
	500	Seed, scout, mech. weed, aerate, fertilize, irrigate, mow	0	1400/ 1300		
Turf: Golf course	16,500	Transplant, hand weed	Irrig: 2 Dry: 7	Irrig: 66 Dry: 46		
	500	Seed, scout, mech. weed, aerate, fertilize, irrigate, mow	0	1400/ 1300	90	3.8E-07 to 1.2E-06

(a) Standard HED values for transfer coefficients based on best available data, including ARTF studies and Thiophanate-methyl study by Brouwer, et al., for greenhouse flowers.
(b) Cancer risks estimated for typical application rate and days of activity per year
Details of inputs appear in Tables 11-14

Table 11a: Thiophanate Methyl: Postapplication Short/Intermediate Term Non-Cancer Risk Estimates using Apple DFR Data											
Crop	Activity	TC cm^2/hr (a)	Maximum Appli-cation Rate (lb ai/A) (b)	NY DAT (days) (c)	WA DAT (days) (c)	NY DFR ug/cm^2 (predicted) (d)	WA DFR ug/cm^2 (actual) (d)	NY Dose (mg/kg/day) (e)	WA Dose (mg/kg/day) (e)	NY MOE (f)	WA MOE (f)
apples	thinning	8000	1	0	0	3.14	2.27	2.87	2.08	35	48
		8000		1	1	2.60	2.27	2.38	2.08	42	48
		8000		6	7	1.00	1.97	0.91	1.80	110	56
		8000		-	28	-	0.79	-	0.73	-	140
	pruning-hand, propping, harvest-hand	3000		0	0	3.14	2.27	1.08	0.78	93	130
		3000		1	-	2.60	-	0.89	-	110	-
	scouting, irrigating, weeding-hand	1000		0	0	3.14	2.27	0.36	0.26	280	390
cherries, nectarines, apricots, plums/prunes	thinning	8000	1	0	0	3.14	2.27	2.87	2.08	35	48
		8000		1	1	2.60	2.27	2.38	2.08	42	48
		8000		6	7	1.00	1.97	0.91	1.80	110	56
		8000		-	28	-	0.79	-	0.73	-	140
	pruning-hand, propping, harvest-hand	3000		0	0	3.14	2.27	1.08	0.78	93	130
		3000		1	-	2.60	-	0.89	-	110	-
		3000		2	-	2.15	-	0.74	-	140	-
	scouting, irrigating, weeding-hand	1000		0	0	3.14	2.27	0.36	0.26	280	390
peaches	thinning	8000	1.6	0	0	4.78	3.46	4.37	3.16	23	32
		8000		1	1	3.96	3.46	3.62	3.16	28	32
		8000		8	7	1.10	3.00	1.01	2.74	99	36
		8000		-	56	-	0.87	-	0.80	-	130
	pruning-hand, propping, harvest-hand	3000		0	0	4.78	3.46	1.64	1.19	61	84
		3000		1	1	3.96	3.46	1.36	1.19	74	84
		3000		2	3	3.27	3.86	1.12	1.32	89	76
		3000		3	7	2.80	3.15	0.96	1.08	100	93
		3000		-	14	-	1.97	-	0.67	-	150
	scouting, irrigating, weeding-hand	1000		0	0	4.78	3.46	0.55	0.40	180	250
almonds	hand-harvesting, hand-pruning	2500	1.4	0	0	4.19	3.03	1.20	0.86	84	120
		2500		1	1	3.46	3.03	0.99	0.86	100	120
		2500		2	3	2.87	3.37	0.82	0.96	120	100
		2500		-	7	-	2.63	-	0.75	-	130
	scouting, thinning	500		0	0	4.19	3.03	0.24	0.17	420	580

Table 11a: Thiophanate Methyl: Postapplication Short/Intermediate Term Non-Cancer Risk Estimates using Apple DFR Data											
Crop	Activity	TC cm^2/hr (a)	Maximum Appli-cation Rate (lb ai/A) (b)	NY DAT (days) (c)	WA DAT (days) (c)	NY DFR ug/cm^2 (predicted) (d)	WA DFR ug/cm^2 (actual) (d)	NY Dose (mg/kg/day) (e)	WA Dose (mg/kg/day) (e)	NY MOE (f)	WA MOE (f)
pecans	hand-harvesting, hand-pruning, thinning	2500	0.7	0	0	2.09	1.51	0.60	0.43	170	230
	scouting, irrigating, hand-weeding	500		0	0	2.09	1.51	0.12	0.09	840	1200
pears	thinning	8000	0.7	0	0	2.09	1.51	1.91	1.38	52	72
		8000		1	1	1.73	1.51	1.58	1.38	63	72
		8000		2	2	1.43	1.69	1.31	1.54	76	65
		8000		4	14	1.05	0.90	0.96	0.82	100	120
	harvesting, pruning, training, tying	3000		0	0	2.09	1.51	0.72	0.52	140	190
	irrigation, scouting, weeding	1000		0	0	2.09	1.51	0.24	0.17	420	580
grapes	grape girdling and cane turning	10000	1	0	0	3.14	2.27	3.59	2.59	28	39
		10000		1	1	2.60	2.27	2.97	2.59	34	39
		10000		2	3	2.15	2.53	2.46	2.89	41	35
		10000		3	5	1.78	2.43	2.03	2.78	49	36
		10000		7	7	0.83	1.97	0.95	2.25	110	44
		10000		-	28	-	0.79	-	0.91	-	110
	hand harvesting, leaf pulling, thinning, pruning, training/tying grapes	5000		0	0	3.14	2.27	1.79	1.30	56	77
		5000		1	1	2.60	2.27	1.48	1.30	67	77
		5000		3	3	1.78	2.53	1.02	1.45	98	69
		5000		4	5	1.47	2.43	0.84	1.39	120	72
		5000		-	14	-	1.29	-	0.74	-	140
	scouting, irrigating, training, tying	1000		0	0	3.14	2.27	0.36	0.26	280	390
woody ornamentals	hand-harvesting, hand-pruning, pinching, transplanting	8000	2.8	0	0	8.37	6.05	7.66	5.53	13	18
		8000		1	1	6.93	6.05	6.33	5.53	16	18
		8000		2	3	5.73	6.75	5.24	6.17	19	16
		8000		3	5	4.74	6.48	4.33	5.92	23	17
		8000		11		1.10	-	1.00	-	100	
		8000		-	70	-	1.33	-	1.21	-	83
		8000		-	84	-	1.19	-	1.09	-	92
	scouting, irrigating	1000		0	0	8.37	6.05	0.96	0.69	100	140

Footnotes:

a Standard activity-specific transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.
b Application rate is the maximum rate on EPA registered thiophanate methyl labels for the short/intermediate term assessment.
c DAT = days after treatment, expressed separately for NY and WA data due to significant differences in residue dissipation rates (climatic). DAT extended beyond current REI of 12 hours to achieve MOE $ 100.
d DFR= dislodgeable foliar residue values from apple study data submitted under MRID 448763-01. The residue values were adjusted arithmetically to account for the difference between the study application rate and assessed maximum application rates for each crop. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. The study was conducted in WA and NY using an application rate of 1.0 lb ai/acre. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. For example, for peaches:
normalized (adjusted) DFR = study DFR x 1.6 lb ai/A assessed rate / 1.0 lb ai/A study application rate
e Daily dermal dose = DFR or TTR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg / body weight (70 kg).
f MOE = NOAEL (100 mg/kg/day) / daily dermal dose (mg/kg/day)

Table 11b: Thiophanate-methyl: Occupational Postapplication Cancer Risk Estimates Using Apple DFR Data

Crop	Activity	TC cm2/hr (a)	Typical Application Rate (lb ai/A) (b)	Exposure Frequency (days/yr) (c)	NY DAT (days) (d)	WA DAT (d)	NY DFR normalized if necessary (e)	WA DFR normalized if necessary (e)	NY ADD (mg/kg/day) (f)	WA ADD (mg/kg/day) (f)	NY LADD (mg/kg/day) (g)	WA ADD (mg/kg/day) (g)	NY Cancer Risk (h)	WA Cancer Risk (h)
apples	pruning-hand, propping, harvest-hand	3000	1	60	Avg 1-14	Avg 1-14	0.999	2.10	0.024	0.050	2.0E-03	4.1E-03	2.7E-05	5.7E-05
		3000		60	16	-	0.151	-	3.6E-03	-	3.0E-04		4.1E-06	
		3000		60	24	84	0.033	0.45	7.9E-04	0.011	6.5E-05	8.8E-04	9.0E-07	1.2E-05
cherries, nectarines, apricots, plums/prunes	pruning-hand, propping, harvest-hand	3000	1	45	Avg 1-14	Avg 1-14	0.999	2.10	0.024	0.050	1.5E-03	3.1E-03	2.0E-05	4.3E-05
		3000		45	14	-	0.221	-	5.3E-03	-	3.3E-04	-	4.5E-06	-
		3000		45	22	84	0.049	0.45	1.2E-03	0.011	7.2E-05	6.6E-04	1.0E-06	9.1E-06
peaches	pruning-hand, propping, harvest-hand	3000	1.3	45	Avg 1-14	Avg 1-14	1.299	2.73	0.031	0.065	1.9E-03	4.0E-03	2.7E-05	5.6E-05
		3000		45	15	-	0.238	-	5.7E-03	-	3.5E-04	-	4.9E-06	-
		3000		45	23	84	0.052	0.58	1.2E-03	0.014	7.7E-05	8.6E-04	1.1E-06	1.2E-05
almonds	hand-harvesting, hand-pruning	2500	1	60	Avg 1-14	Avg 1-14	0.999	2.10	2.0E-02	0.042	1.6E-03	3.4E-03	2.3E-05	4.8E-05
		2500		60	15	-	0.183	-	3.7E-03	-	3.0E-04	-	4.2E-06	-
		2500		60	23	84	0.040	0.45	8.0E-04	0.009	6.6E-05	7.3E-04	9.1E-07	1.0E-05
pecans	hand-harvesting, hand-pruning, thinning	2500	0.6	60	Avg 1-14	Avg 1-14	0.599	1.26	1.2E-02	0.025	9.9E-04	2.1E-03	1.4E-05	2.9E-05
		2500		60	Avg 9-14	-	0.224	-	4.5E-03	-	3.7E-04	-	5.1E-06	-
		2500		60	20	84	0.043	0.27	8.5E-04	0.005	7.0E-05	4.4E-04	9.7E-07	6.1E-06

Table 11b: Thiophanate-methyl: Occupational Postapplication Cancer Risk Estimates Using Apple DFR Data

Crop	Activity	TC cm2/hr (a)	Typical Application Rate (lb ai/A) (b)	Exposure Frequency (days/yr) (c)	NY DAT (days) (d)	WA DAT (d)	NY DFR normalized if necessary (e)	WA DFR normalized if necessary (e)	NY ADD (mg/kg/day) (f)	WA ADD (mg/kg/day) (f)	NY LADD (mg/kg/day) (g)	WA ADD (mg/kg/day) (g)	NY Cancer Risk (h)	WA Cancer Risk (h)
pears	harvesting, pruning, training, tying	3000	0.6	60	Avg 1-14	Avg 1-14	0.599	1.26	1.4E-02	0.030	1.2E-03	2.5E-03	1.6E-05	3.4E-05
		3000		60	Avg 11-14	-	0.180	-	4.3E-03	-	3.6E-04	-	4.9E-06	-
		3000		60	21	84	0.035	0.27	8.5E-04	0.006	7.0E-05	5.3E-04	**9.6E-07**	7.3E-06
grapes	hand harvesting, leaf pulling, thinning, pruning, training/tying grapes	5000	1	105	Avg 1-14	Avg 1-14	0.999	2.10	4.0E-02	0.084	5.7E-03	1.2E-02	7.9E-05	1.7E-04
		5000		105	21	-	0.059	-	2.4E-03	-	3.4E-04	-	4.7E-06	-
		5000		105	29	84	0.013	0.45	5.2E-04	0.018	7.5E-05	2.6E-03	**1.0E-06**	3.5E-05
woody ornamentals	hand-harvesting, hand-pruning, pinching, transplanting	8000	2.1	30	Avg 1-14	Avg 1-14	2.914	4.41	1.9E-01	0.282	7.7E-03	1.2E-02	1.1E-04	1.6E-04
		8000	2.1	30	24	-	0.096	-	6.2E-03	-	2.5E-04	-	3.5E-06	-
		8000	2.1	30	30	84	0.032	0.94	2.1E-03	0.060	8.4E-05	2.5E-03	1.2E-06	3.4E-05

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.
b Application rate is the typical application rate, if known, or maximum label rate if not available. Sources include BEAD, label, and registrant-provided information.
c Exposure frequency = estimated average days performing activity in a season. Factors include crop size, season length, other information from USDA, ARTF, CA DPR databases.
d DAT = days after treatment. 14-day average (DAT 1-14) used; DAT extended in some cases to reduce cancer risk estimates to 10^{-6}, where feasible.
e DFR= dislodgeable foliar residue values from apple study data submitted under MRID 448763-01. The residue values were adjusted arithmetically to account for the difference between the study application rate and assessed typical application rates for each crop. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. The study was conducted in WA and NY using an application rate of 1.0 lb ai/acre. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. For example, for peaches:
normalized (adjusted) DFR = study DFR x 1.6 lb ai/A assessed rate / 1.0 lb ai/A study application rate
f Absorbed daily dose = daily dermal dose x dermal absorption factor (0.07): Daily dermal dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg / body weight (70 kg).
g LADD (mg/kg/day) = absorbed daily dose (mg/kg/day) x exposure frequency (days/year) x 35 years / (365 days/year x 70 year lifetime); where absorbed daily dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.07) / body weight (70 kg adult).
h Cancer risk = LADD x Q_1^*; where Q_1^* = 0.0138 $mg/kg/day^{-1}$;

Table 12a: Thiophanate-methyl: Occupational Postapplication Short/Intermediate and Long Term Non-Cancer Risk Estimates Using Cut Flower DFR Data									
Crop	Activity	TC cm^2/hr (a)	Maximum Application Rate (lb ai/A) (b)	DAT (days) (c)	DFR ug/cm^2 normalized (d)	Short- Intermediate-term Dose (mg/kg/day) (e)	Short-Intermediate-term MOE (f)	Absorbed Dose (mg/kg/day) (g)	Long Term MOE (h)
cut flowers	"Typical" activities as measured by Brouwer, et al.	4500	2.8	0	12.3	6.3	16	0.44	18
				48	1.9	0.97	100	0.068	120
	hand-harvesting, pinching, thinning, hand-pruning	7000		0	12.3	9.8	10	0.69	12
				1	11.8	9.4	11	0.66	12
				2	11.4	9.1	11	0.64	13
				59	1.2	1.0	100	0.068	120
	irrigating, scouting	4000		0	12.3	5.6	18	0.39	20
				1	11.8	5.4	19	0.38	21
				2	11.4	5.2	19	0.36	22
				45	2.1	0.97	100	0.068	120
	hand-weeding	2500		0	12.3	3.5	29	0.25	33
		2500		1	11.8	3.4	30	0.24	34
		2500		2	11.4	3.24	31	0.23	35
		2500		33	3.4	0.97	100	0.068	120
herbaceous ornamentals other than cut flowers	hand-harvesting, pinching, thinning, hand-pruning	7000	2.8	0	12.3	9.8	10	0.69	12
		7000		1	11.8	9.4	11	0.66	12
		7000		2	11.4	9.1	11	0.64	13
		7000		59	1.2	1.0	100	0.070	120
	irrigating, scouting	4000		0	12.3	5.6	18	0.39	20
		4000		1	11.8	5.4	19	0.38	21
		4000		2	11.4	5.2	19	0.36	22
		4000		45	2.12	0.97	100	0.068	120
	hand-weeding	2500		0	12.3	3.5	29	0.25	33
		2500		1	11.8	3.4	30	0.24	34
		2500		2	11.4	3.2	31	0.23	35
		2500		33	3.4	0.97	100	0.68	120

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.

b Application rate is the maximum rate on EPA registered thiophanate methyl labels.
c DAT = days after treatment. DAT extended beyond current REI of 12 hours to achieve MOE $ 100.
d DFR= dislodgeable foliar residue values from cut flower greenhouse study data submitted under MRID 450275-01: Study conducted at 1.1 lb ai/A. The residue values were adjusted to account for the difference in study application rate and assessed maximum application rates. DFR residues derived using the data from the average of roses and mums greenhouse sites.
e Short/intermediate-term dermal dose = TTR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg / body weight (70 kg).
f Short/Intermediate-term MOE = NOAEL (100 mg/kg/day) / daily dermal dose (mg/kg/day)
g Absorbed dermal dose = dermal dose x dermal absorption factor (0.07)
h Long-term MOE = NOAEL (100 mg/kg/day) / absorbed dermal dose (mg/kg/day)

Note: Bold = Short/Intermediate-term MOE >100.

Table 12b: Thiophanate-methyl: Occupational Postapplication Cancer Risk Estimates Using Cut Flower DFR Data (Average of Roses and Mums Data)

Crop	Activity	TC cm^2/hr (a)	Typical Application Rate (lbs ai/acre) (b)	Exposure Frequency (days/yr) (c)	DAT (days) (d)	DFR (ug/cm^2) (e)	DFR Normalized (ug/cm^2) (e)	ADD (mg/kg/day) (f)	LADD (mg/kg/day) (g)	Cancer Risk (h)
cut flowers	hand-harvesting, pinching, thinning, hand-pruning	4500	2.1	90	Avg DAT 1-14	3.64	6.96	0.25	0.031	4.3E-04
		7000	2.1	90	135	0.025	0.047	2.7E-03	3.3E-04	4.5E-06
			2.1	90	170	6.3E-03	0.012	6.7E-04	8.3E-05	1.1E-06
		4500	2.1	90	Avg DAT 1-14	3.644	7.0	0.250	0.031	4.3E-04
herbaceous ornamentals other than cut flowers	irrigating, scouting	4000	2.1	90	Avg DAT 1-14	3.644	6.957	0.22	0.027	3.79E-04
		4000	2.1	90	120	0.045	0.085	2.7E-03	3.4E-04	4.63E-06
		4000	2.1	90	155	0.011	0.022	7.0E-04	8.6E-05	1.18E-06

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.
b Application rate is the typical application rate, if known, or maximum label rate if not available. Sources include BEAD, label, and registrant-provided information.
c Exposure frequency = estimated average days performing activity in a season. Greenhouses assumed to be year-round activity with potential for multiple crops per year.
d DAT = days after treatment. 14-day average (DAT 1-14) used; DAT extended in some cases to reduce cancer risk estimates to 10^{-6}, where feasible.
e DFR= dislodgeable foliar residue values from cut flower greenhouse study data submitted under MRID 450275-01: Study conducted at 1.1 lb ai/A. The residue values were adjusted to account for the difference in study application rate and assessed typical application rates. DFR residues derived using the data from the average of roses and mums greenhouse sites.
f Absorbed daily dose = daily dermal dose x dermal absorption factor (0.07): Daily dermal dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg / body weight (70 kg).
g LADD (mg/kg/day) = absorbed daily dose (mg/kg/day) x exposure frequency (days/year) x 35 years / (365 days/year x 70 year lifetime); where absorbed daily dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.07) / body weight (70 kg adult).
h Cancer risk = LADD x Q_1^*; where $Q_1^* = 0.0138\ mg/kg/day^{-1}$;

Table 13a: Thiophanate-methyl: Occupational Postapplication Short-, Intermediate- and Long-term Non-Cancer Risk Estimates Using Strawberry DFR Data							
Crop	Activity	TC cm^2/hr (a)	Maximum Application Rate (lb ai/A) (b)	DAT (days) (c)	DFR ug/cm^2 (d)	Dose (mg/kg/day) (e)	MOE (f)
strawberries	harvesting-hand, pinching, hand-pruning, training	1500	0.70	0	2.39	0.41	**240 [LT = 280**
	irrigating, mulching, scouting, hand-weeding	400		0	2.39	0.11	**910 [LT = 1000]**
wheat	irrigating, scouting	1500		0	2.39	0.41	**240**
cucurbits	hand-harvesting, leaf puling, hand-pruning	2500	0.35	0	1.20	0.34	**290**
	hand-weeding, irrigating, scouting	1500		0	1.20	0.21	**490**
sugar beets	irrigating, scouting	1500	0.35	0	1.20	0.21	**490**
	hand-weeding, thinning	100		0	1.20	0.014	**7,300**
soybeans	irrigating, scouting	1500	0.7	0	2.39	0.41	**240**
	hand-weeding	100		0	2.39	0.027	**3,700**
beans	hand-harvesting	2500	1.4	0	4.79	1.37	73
				1	3.11	0.89	**110**
	irrigating, scouting	1500		0	4.79	0.82	**120**
	thinning	100		0	4.79	0.055	**1,800**
potatoes	hand-harvesting	2500	1.0	0	3.42	0.98	**100**
	irrigating, scouting mature plants	1500		0	3.42	0.59	**170**
	irrigating, scouting, thinning, weeding immature plants	300		0	3.42	0.12	**850**
herbaceous ornamentals	hand harvesting, hand pruning, thinning, transplanting	7000	2.8	0	9.58	7.66	13
				1	2.22	1.78	56
				2	1.45	1.16	86
				3	0.94	0.75	**130**
	scouting, irrigating	1500		0	9.58	1.64	61
				1	2.22	0.38	**260**

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.

b Application rate is the maximum rate on EPA registered thiophanate methyl labels for the short/intermediate term assessment and typical application rate, if known, is used for the cancer assessment.

c DAT = days after treatment.

d DFR = dislodgeable foliar residue predicted from study data submitted under the strawberry study - 44866201; Study conducted at 0.72 lb ai/A; DFR residues derived using the data from the average of NC and CA sites. The residue values were adjusted to account for the difference in study application rate and assessed maximum application rates.

e Dermal dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg / body weight (70 kg).

f For the short/intermediate term assessment MOE = NOAEL (100 mg/kg/day) / daily dermal dose (mg/kg/day). For the long term assessment MOE = Oral NOAEL (8 mg/kg/day) / absorbed daily dermal dose (mg/kg/day) where absorbed daily dermal dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.07) / body weight (70 kg adult).

Table 13b: Thiophanate-methyl: Occupational Postapplication Cancer Risk Estimates using Strawberry DFR Data								
Crop	Activity/ Tc (cm^2/hr) [a]	Typical Application Rate (lb ai/acre)[b]	Exposure Frequency (days/yr) [c]		DFR (ug/cm2) [d]	DFR Normalized (ug/cm^2) [d]	LADD (mg/kg/day) [e]	Cancer Risk DAT 1-14 [f]
straw-berries	(1500) harvesting-hand, pinching, hand-pruning, training (1500)	0.6	180	Avg DAT 1-14	0.32	0.27	0.00081	1.1E-05
				Avg DAT 4-14	0.11	0.09	0.00028	3.9E-06
				Avg 8-14	0.03	0.03	7.6E-05	1.0E-06
	(400) irrigating, mulching, scouting, hand-weeding			Avg DAT 4-14	0.11	0.09	7.4E-05	1.0E-06
wheat	(1500) irrigating, scouting	0.7	15	Avg DAT 1-14	0.32	0.32	7.8E-05	1.1E-06
cucurbits	(2500) hand-harvesting, leaf pulling, hand-pruning	0.35	60	Avg DAT 4-14	0.32	0.16	0.00026	3.6E-06
				Avg DAT 5-14	0.08	0.04	6.5E-05	8.9E-07
sugar beets	(1500) irrigating, scouting	0.35	30	Avg DAT 1-14	0.32	0.16	7.8E-05	1.1E-06
soybeans	(1500) irrigating, scouting	0.7	45	Avg DAT 1-14	0.32	0.32	0.00023	3.2E-06
beans	(2500) hand-harvesting	1	45	Avg DAT 1-14	0.32	0.45	0.00056	7.7E-06
				Avg DAT 7-14	0.04	0.06	7.2E-05	9.9E-07
potatoes	(2500) hand-harvesting	1	45	Avg DAT 1-14	0.32	0.45	0.00056	7.7E-06
		1	45	Avg DAT 3-14	0.16	0.22	0.00028	3.8E-06
		1	45	Avg DAT 7-14	0.04	0.06	7.2E-05	9.9E-07
herbaceous ornamentals	(7000) hand harvesting, hand pruning, thinning, transplanting	2.1	120	Avg DAT 1-14	0.32	0.95	0.0088	1.2E-04
		2.1	120	Avg 11-14	0.012	0.037	0.00034	4.7E-06
		2.1	120	DAT 16	0.0025	0.0074	6.8E-05	**9.4E-07**

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.

b Application rate is the typical application rate, if known, or maximum label rate if not available. Sources include BEAD, label, and registrant-provided information.

c Exposure frequency = estimated average days performing activity in a season, based on best available crop and worker reentry data from USDA, BEAD, ARTF, and other sources.
DAT = days after treatment. 14-day average (DAT 1-14) used; DAT extended in some cases to reduce cancer risk estimates to 10^{-6}, where feasible.

d DFR = dislodgeable foliar residue predicted from study data submitted under the strawberry study - MRID 448662-01. The residue values were adjusted (normalized) to account for the difference in study application rate and assessed at typical application rates (where available).

e LADD (mg/kg/day) = absorbed daily dose (mg/kg/day) x exposure frequency (days/year) x 35 years / (365 days/year x 70 year lifetime); where absorbed daily dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.07) / body weight (70 kg adult).

f Cancer risk = LADD x Q_1^*; where Q_1^* = 0.0138 mg/kg/day^{-1}

Table 14a: Thiophanate-methyl: Occupational Postapplication Short/Intermediate Term Non-Cancer Risk Estimates Using Turf Residue Data									
Crop	Activity	TC cm^2/hr [a]	DAT (days)	CA/GA TTR ug/cm^2 (predicted, normalized) [b]	PA TTR ug/cm^2 (predicted, normalized) [b]	CA/GA Dose (mg/kg/day) [c]	PA Dose (mg/kg/day) [c]	CA/GA MOE [d]	PA MOE [d]
turf - sod farms	hand-harvesting , transplanting, hand-weeding	16,500	0	1.27	1.38	2.39	2.61	42	38
			1	0.80	1.16	1.51	2.20	66	46
			2	0.51	0.98	0.96	1.85	100	54
			3	0.32	0.83	0.60	1.56	170	64
			7	-	0.42	-	0.79	-	130
	seeding, scouting, mechanical weeding, aerating, fertilizing, hand pruning, irrigating, mowing	500	0	1.27	1.38	0.07	0.08	1,400	1,300
turf - golf course	transplanting, hand-weeding	16,500	0	1.27	1.38	2.39	2.61	42	38
		16,500	1	0.80	1.16	1.51	2.20	66	46
		16,500	2	0.51	0.98	0.96	1.85	100	54
		16,500	3	0.32	0.83	0.60	1.56	170	64
		16,500	7	-	0.42	-	0.79	-	130
	seeding, scouting, mechanical weeding, aerating, fertilizing, hand pruning, irrigating, mowing	500	0	1.27	1.38	0.07	0.08	1,400	1,300

Footnotes:

a Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.

b TTR = turf transferable residue predicted from study data submitted under MRID 450007-01. The residue values were adjusted to account for the difference in study application rate and assessed maximum application rate of 15 lb ai/A. Study conducted at 19 lb ai/A at the PA site and 22 lb ai/A at the combined average of CA and GA sites; DFR residues derived using data from: (1) the PA site and (2) average of the GA and CA sites.

c Dermal dose = TTR ($\mu g/cm^2$) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 μg / body weight (70 kg).

d MOE = NOAEL (100 mg/kg/day) / daily dermal dose (mg/kg/day)

DAT = Days after treatment with thiophanate-methyl

Table 14b: Thiophanate-methyl: Occupational Postapplication Cancer Risk Estimates Using Turf Residue Data															
Crop	Activity	Typical Application Rate (lb ai/A)[a]	Exposure Frequency (days/yr)[b]	DAT (days) PA	DAT (days) CA/GA	PA DFR (ug/cm^2)[c]	CA/GA DFR (ug/cm^2)[c]	PA DFR Normalized (ug/cm^2)[c]	CA/GA DFR Normalized (ug/cm^2)[c]	PA ADD (mg/kg/day)[d]	CA/GA ADD (mg/kg/day)[d]	PA LADD (mg/kg/day)[e]	CA/GA LADD (mg/kg/day)[e]	PA Cancer Risk[f]	CA/GA Cancer Risk[f]
turf - sod farms	hand-harvesting , transplanting, hand-weeding	5.4	90	Avg 1-14	Avg 1-14	0.61	0.23	0.173	0.056	0.023	7.5E-03	2.8E-03	9.2E-04	3.9E-05	1.3E-05
			90	21	Avg 7-14	0.059	0.025	0.017	6.1E-03	2.2E-03	8.1E-04	2.7E-04	1.0E-04	3.8E-06	1.4E-06
			90	28	Avg 8-14	0.016	0.018	4.5E-03	4.4E-03	6.0E-04	5.8E-04	7.4E-05	7.2E-05	1.0E-06	9.9E-07
turf - golf course	seeding, scouting, mechanical weeding, aerating, fertilizing, hand pruning, irrigating, mowing	5.4	90	Avg 1-14	Avg 1-14	0.61	0.23	0.173	0.056	6.9E-04	2.3E-04	8.5E-05	2.8E-05	1.2E-06	3.8E-07
			90	Avg 2-14		0.54		0.153		6.1E-04		7.6E-05		1.0E-06	

a Typical application rate determined by label and registrant-provided information.

b Exposure frequency (days/year) = days performing work per year based on available agricultural worker survey data.
DAT = Days after treatment.

c TTR = turf transferable residues: based on turf study residues - MRID 450007-01; Study conducted at 19 lb ai/A at the PA site and 22 lb ai/A at the combined average of CA and GA sites; DFR residues derived using data from: (1) the PA site and (2) average of the GA and CA sites; normalized to 5.4 lb ai/acre typical rate for cancer assessment.

d Absorbed dermal dose = TTR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.07) / body weight (70 kg adult).

e LADD (mg/kg/day) = absorbed daily dose (mg/kg/day) x exposure frequency (days/year) x 35 years / (365 days/year x 70 year lifetime)

f Cancer risk = LADD x Q_1^*; where $Q_1^* = 0.0138\ mg/kg/day^{-1}$

Table 15. Occupational Short/Intermediate and Long Term and Cancer Postapplication Risks from MBC Residues after Thiophanate-methyl Application

Crop	Activity	Site[a] (if applicable)	Maximum MBC residue [b]	Maximum MBC residue normalized if applicable [c]	Maximum MBC residue normalized for cancer assessment if applicable[d]	Transfer Coefficient (cm2/hr)[e]	MBC Short-Int-term MOE[f]	MBC Long-term MOE[g] (mg/kg/day)	Exposure Frequency (days/yr)	MBC Cancer Risk[h]
Turf Study TTR Values[i]										
turf-sod farms	hand-harvesting , transplanting, hand-weeding	CA/GA	0.070	0.048	0.024	16,500	2,700	NA	90	4.6e-07
		PA	0.070	0.055	0.032	16,500	2,400	NA	90	6.2e-07
turf - golf courses	seeding, scouting, mechanical weeding, aerating, fertilizing, hand pruning, irrigating, mowing	CA/GA	0.070	0.048	0.024	500	90,000	NA	90	1.4e-08
		PA	0.070	0.055	0.032	500	77,000	NA	90	1.9e-08
Strawberry Study DFR Values[j]										
strawberries	harvesting-hand, pinching, hand-pruning, training	-	0.070	0.070	0.058	1,500	20,000	6,000	180	2.1e-07
	irrigating, mulching, scouting, hand-weeding	-	0.070	0.070	0.058	400	77,000	NA	-	-
wheat	irrigating, scouting	-	0.070	0.070	0.070	1,500	20,000	NA	30	4.1e-08
cucurbits	hand-harvesting, leaf pulling, hand-pruning	-	0.070	0.034	0.034	2,500	25,000	NA	60	6.7e-08
	hand-weeding, irrigating, scouting	-	0.070	0.034	0.034	1,500	42,000	NA	-	-
sugar beets	irrigating, scouting	-	0.070	0.034	0.034	1,500	42,000	NA	30	2.0e-08
	hand-weeding, thinning	-	0.070	0.034	0.034	100	630,000	NA	-	-
soybeans	irrigating, scouting	-	0.070	0.070	0.070	1,500	20,000	NA	45	6.2e-08
	hand-weeding	-	0.070	0.070	0.070	100	310,000	NA	-	-
beans	hand-harvesting	-	0.070	0.14	0.097	2,500	6,300	NA	45	1.4e-07
	irrigating, scouting	-	0.070	0.14	0.097	1,500	10,000	NA	-	-
	thinning	-	0.070	0.14	0.097	100	160,000	NA	-	-
potatoes	hand-harvesting	-	0.070	0.097	0.097	2,500	8,800	NA	45	1.4e-07
	irrigating, scouting mature plants	-	0.070	0.097	0.097	1,500	15,000	NA	-	-
	irrigating, scouting, thinning, weeding immature plants	-	0.070	0.097	0.097	300	73,000	NA	-	-
herbaceous ornamentals	hand harvesting, hand pruning, thinning, transplanting	-	0.070	0.27	0.20	7,000	1,100	NA	120	2.2e-06
	scouting, irrigating	-	0.070	0.27	0.20	1,500	5,200	NA	-	-
Apple Study DFR Values[k]										
apples	thinning	NY	0.23	0.23	0.23	8,000	1,200	NA	-	-
		WA	0.39	0.39	0.39	8,000	690	NA	-	-
	pruning-hand, propping, harvest-hand	NY	0.23	0.23	0.23	3,000	3,100	NA	60	5.4e-07
		WA	0.39	0.39	0.39	3,000	1,800	NA	60	9.2e-07
	scouting, irrigating, weeding-hand	NY	0.23	0.23	0.23	1,000	9,300	NA	-	-
		WA	0.39	0.39	0.39	1,000	5,500	NA	-	-

Table 15. Occupational Short/Intermediate and Long Term and Cancer Postapplication Risks from MBC Residues after Thiophanate-methyl Application										
Crop	Activity	Site[a] (if applicable)	Maximum MBC residue [b]	Maximum MBC residue normalized if applicable [c]	Maximum MBC residue normalized for cancer assessment if applicable[d]	Transfer Coefficient (cm2/hr)[e]	MBC Short-Int-term MOE[f]	MBC Long-term MOE[g] (mg/kg/day)	Exposure Frequency (days/yr)	MBC Cancer Risk[h]
cherries, nectarines, apricots, plums/prunes	thinning	NY	0.23	0.23	0.23	8,000	1,200	NA	-	-
		WA	0.39	0.39	0.39	8,000	690	NA	-	-
	pruning-hand, propping, harvest-hand	NY	0.23	0.23	0.23	3,000	3,100	NA	45	4.1e-07
		WA	0.39	0.39	0.39	3,000	1,800	NA	45	6.9e-07
	scouting, irrigating, weeding-hand	NY	0.23	0.23	0.23	1,000	9,300	NA	-	-
		WA	0.39	0.39	0.39	1,000	5,500	NA	-	-
peaches	thinning	NY	0.23	0.37	0.30	8,000	730	NA	-	-
		WA	0.39	0.62	0.51	8,000	430	NA	-	-
	pruning-hand, propping, harvest-hand	NY	0.23	0.37	0.30	3,000	1,900	NA	45	5.3e-07
		WA	0.39	0.62	0.51	3,000	1,100	NA	45	9.0e-07
	scouting, irrigating, weeding-hand	NY	0.23	0.37	0.30	1,000	5,800	NA	-	-
		WA	0.39	0.62	0.51	1,000	3,400	NA	-	-
almonds	hand-harvesting, hand-pruning	NY	0.23	0.32	0.23	2,500	2,700	NA	60	4.5e-07
		WA	0.39	0.55	0.39	2,500	1,600	NA	60	7.7e-07
	scouting, thinning	NY	0.23	0.32	0.23	500	13,000	NA	-	-
		WA	0.39	0.55	0.39	500	7,800	NA	-	-
pecans	hand-harvesting, hand-pruning, thinning	NY	0.23	0.16	0.14	2,500	5,300	NA	60	2.7e-07
		WA	0.39	0.27	0.23	2,500	3,100	NA	60	4.6e-07
	scouting, irrigating, hand-weeding	NY	0.23	0.16	0.14	500	27,000	NA	-	-
		WA	0.39	0.27	0.23	500	16,000	NA	-	-
pears	thinning	NY	0.23	0.16	0.14	8,000	1,700	NA	-	-
		WA	0.39	0.27	0.23	8,000	980	NA	-	-
	harvesting, pruning, training, tying	NY	0.23	0.16	0.14	3,000	4,400	NA	60	3.3e-07
		WA	0.39	0.27	0.23	3,000	2,600	NA	60	5.5e-07
	irrigation, scouting, weeding	NY	0.23	0.16	0.14	1,000	13,000	NA	-	-
		WA	0.39	0.27	0.23	1,000	7,800	NA	-	-
grapes	grape girdling and cane turning	NY	0.23	0.23	0.23	10,000	930	NA	-	-
		WA	0.39	0.39	0.39	10,000	550	NA	-	-
	hand harvesting, leaf pulling, thinning, pruning, training/tying	NY	0.23	0.23	0.23	5,000	1,900	NA	75	**1.1e-06**
		WA	0.39	0.39	0.39	5,000	1,100	NA	75	1.9e-06
	scouting, irrigating, training, tying	NY	0.23	0.23	0.23	1,000	9,300	NA	-	-
		WA	0.39	0.39	0.39	1,000	5,500	NA	-	-
woody ornamentals	hand-harvesting, hand-pruning, pinching, transplanting	NY	0.23	0.64	0.48	8,000	420	NA	30	1.5e-06
		WA	0.39	1.09	0.82	8,000	250	NA	30	2.6e-06
	scouting, irrigating	NY	0.23	0.64	0.48	1,000	3,300	NA	-	-
		WA	0.39	1.09	0.82	1,000	2,000	NA	-	-

Table 15. Occupational Short/Intermediate and Long Term and Cancer Postapplication Risks from MBC Residues after Thiophanate-methyl Application

Crop	Activity	Site[a] (if applicable)	Maximum MBC residue [b]	Maximum MBC residue normalized if applicable [c]	Maximum MBC residue normalized for cancer assessment if applicable[d]	Transfer Coefficient (cm2/hr)[e]	MBC Short-Int-term MOE[f]	MBC Long-term MOE[g] (mg/kg/day)	Exposure Frequency (days/yr)	MBC Cancer Risk[h]
Cut Flower Study DFR Values[l]										
cut flowers (greenhouse)	hand-harvesting, pinching, thinning, hand-pruning	-	0.25	0.71	0.53	7,000	430	130	90	4.4e-06
	irrigating, scouting	-	0.25	0.71	0.53	4,000	760	220	-	-
	hand-weeding	-	0.25	0.71	0.53	2,500	1,200	350	-	-
herbaceous ornamentals other than cut flowers (greenhouse)	hand-harvesting, pinching, thinning, hand-pruning	-	0.25	0.71	0.53	7,000	430	130		
	irrigating, scouting	-	0.25	0.71	0.53	4,000	760	220	60	1.7e-06
	hand-weeding	-	0.25	0.71	0.53	2,500	1,200	350	-	-

Footnotes:

a Site (if applicable) indicates the specific source of the MBC residue levels used in the assessment.

b Maximum MBC residue determined from the Thiophanate methyl studies was used to determine risks, and is listed for each assessed site.

c Maximum MBC residue normalized (adjusted) to account for the different maximum application rates for each crop (see Tables 9, 10, 11, 12 for details on specific application rates.

d Maximum MBC residue normalized (adjusted) to account for the different typical application rates for each crop (used in the cancer risk estimates). See Tables 9,10,11, and 12 for specific application rates.

e Transfer coefficients based on EPA Science Advisory Policy Memo 003.1, dated 8/7/00.

f Short/Intermediate-term MOE = Oral NOAEL (10 mg/kg/day) / absorbed daily dermal dose (mg/kg/day) where absorbed daily dermal dose = DFR or TTR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.035) / body weight (60 kg developmental female).

g Long-term MOE = Oral NOAEL (2.5 mg/kg/day) / absorbed daily dermal dose (mg/kg/day) where absorbed daily dermal dose = DFR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.035) / body weight (70 kg adult).

h MBC cancer risk = LADD x Q_1^*; where Q_1^* = 0.00239 mg/kg/day^{-1}; and LADD (mg/kg/day) = absorbed daily dose (mg/kg/day) x exposure frequency (days/year) x 35 years / (365 days/year x 70 year lifetime); and where absorbed daily dose = MBC DFR or TTR (Fg/cm^2) x Tc (cm^2/hr) x 8 hours/day x mg/1,000 Fg x dermal absorption factor (0.035) / body weight (70 kg adult).

i Turf study maximum daily average MBC TTR values used (application rate of 22 lb ai/acre (avg CA/GA) and 19 lb ai/acre (PA)); adjusted to account for crops assessed at differing application rates. Residues from CA and GA were combined for one assessment, and PA residues were assessed separately.

j Strawberry study maximum daily average MBC DFR values used (application rate of 0.72 lb ai/acre); adjusted to account for different allowable application rates for different crops. Residues for the CA and NC sites were averaged.

k Apple study maximum daily average MBC DFR values used (application rate of1.05 lb ai/acre); adjusted to account for different allowable application rates for different crops. Residues for WA and NY were assessed separately.

l Cut flower study maximum daily average MBC DFR values used; (application rate of1.1 lb ai/acre); adjusted to account for different allowable application rates for different crops. Residues for mums and roses were averaged.

Table 16: Short-Term Exposure and Risk Estimates (MOE) for Homeowner Lawn /Garden Application with Thiophanate Methyl										
Equipment Type	**Dermal Unit Exposure (mg/lb ai) (a)**	**Inhalation Unit Exposure (mg/lb ai) (b)**	**lb ai / acre (c)**	**Acres/ day (d)**	**Dermal Dose (non-absorbed) (mg/kg/day) (e)**	**Inhalation Dose (mg/kg/day) (f)**	**Dermal MOE (g)**	**Inhalation MOE (h)**	**Total MOE (i) (Target$300)**	**Cancer Risk Estimate (50 applications per lifetime) (j)**
(1a) Applying with a RTU hose-end sprayer (ORETF data)	2.6	0.011	19 (spot)	0.025 (1,000 ft^2)	0.018	7.5E-5	5,600	130,000	5,400	3.6E-8
			1.8 (ornamentals)	0.25 (11,000 ft^2) (4 quarts product)	0.017	7.1E-5	6,000	140,000	5,800	3.4E-8
(1b) Mixing, loading, and applying liquid with a hose-end sprayer (ORETF data)	11	0.016	15	0.5	1.2	1.7E-03	85	5800	84	2.3E-06
(2) Mixing/Loading/ Applying Wettable Powders with a Low Pressure Handwand	250	1.1	15	0.025 (1,000 ft^2)	1.34	5.9E-3	**75**	1,700	**72**	2.7E-7
			0.007 lb ai/gal	5 gal	0.13	5.5E-4	800	18,000	770	1.0E-6
(3) Mixing/Loading/ Applying Liquids with a Low Pressure Handwand	100	0.03	15	0.025 (1,000 ft^2)	0.54	1.6E-4	**190**	62,000	**190**	9.5E-6
			0.007 lb ai/gal	5 gal	0.05	1.5E-5	2,000	670,000	2,000	9.4E-8
(4) Mixing/Loading/ Applying with a Backpack Sprayer	5.1	0.03	15	0.025 (1,000 ft^2)	0.027	1.6E-4	3,700	62,000	3,500	5.6E-8
			0.007 lb ai/gal	5 gal	0.0026	1.5E-5	39,000	670,000	37,000	5.2E-9
(5) Loading/Applying with a Push-type Spreader (ORETF data)	0.68	0.00091	11	0.5	0.053	7.2E-5	1,900	140,000	1,900	Not applicable
			5.4		0.026	3.5E-5	3,800	280,000	3,700	5.1E-8
(6) Loading/Applying with a Belly Grinder	110	0.062	11	0.025 (1,000 ft^2)	0.43	2.4E-04	**230**	41,000	**230**	8.2E-7
(7) Hand Dispersal of Granules (Spot Treatment)	430	0.47	11	0.025 (1,000 ft^2)	1.67	1.8E-03	**59**	5,400	**58**	**3.2E-6**

* Values rounded to two significant figures

(c) Dermal unit exposure from PHED represents short-sleeved shirt and shorts, no gloves; open mixing/loading and application by same person.
(b) Inhalation unit exposure from PHED; no respirator.
(c) Range of application rates based on labels.
(d) Amounts of acreage treated per day are from the Residential SOP for area treated in a single day for each exposure scenario of concern.
(e) Daily Dermal Dose (mg/kg/day) = [Dermal Exposure (UE mg/lb ai * lb ai/acre] / Body Weight (70 kg)]..
(f) Daily Inhalation Dose (mg/kg/day) = [Inhalation Exposure (UE mg/lb ai * lb ai/day = mg ai/day] / Body Weight (70 kg)].
(g) Dermal MOE = NOAEL (100 mg/kg/day) / Daily Dermal Dose mg/kg/day). Dermal NOAEL from a dermal study, therefore, no adjustment is made for dermal absorption.
(h) Inhalation MOE = NOAEL (10 mg/kg/day) / Daily Inhalation Dose (mg/kg/day).
(i) Total MOE = 1/ (1/MOE dermal + 1/MOE inhalation).
(j) Cancer risk estimates = LADD * Q_1^*, where $Q_1^* = 0.0138$ $(mg/kg/day)^{-1}$
where LADD = total absorbed dose [(Dermal dose * 0.07) + Inhalation Dose] * average days of exposure(1)/year x (50) years of expected exposure/ (365 days/year x 70 year lifetime);

Table 17a: Thiophanate-methyl: Residential Postapplication Activities on Treated Turf: Dermal Exposure and Non-Cancer Risk Estimates
(Thiophanate-methyl Residues Only)

			Short-term Risk Estimates							Intermediate-term Risk Estimates						
Activity	Formulation	Application Rate (lb ai/acre)	TTR (CA/GA sites) Fg/cm^2 (normalized) DAT 0 (a)	TTR (PA) Fg/cm^2 (normalized) (DAT 0) (a)	Transfer Coefficient (cm^2/hr) (b)	CA/GA Dermal Dose (mg/kg/ day) (c)	PA Dermal Dose (mg/kg/ day) (c)	CA/GA MOE (d)	PA MOE (d)	TTR (CA/GA sites) Fg/cm^2 (normalized) DAT 7 (a)	TTR (PA) Fg/cm^2 (normalized) DAT 7 (a)	Transfer Coefficient (cm^2/hr) (b)	CA/GA Dermal Dose (mg/kg/ day) (c)	PA Dermal Dose (mg/kg/ day) (c)	CA/GA MOE (d)	PA MOE (d)
high contact lawn activities: adults	Granular	11	0.93	1.01	14,500	0.39	0.42	260	240	0.038	0.31	7,300	0.0078	0.064	13,000	1,600
	Liquid	15	1.27	1.38	14,500	0.53	0.57	190	170	0.051	0.42	7,300	0.0106	0.087	9,400	1,100
	Liquid (Spot)	19.3	1.63	1.78	14,500	0.68	0.74	150	140	0.066	0.54	7,300	0.0137	0.11	7,300	890
high contact lawn activities: toddler	Granular	11	0.93	1.01	5200	0.64	0.7	160	140	0.038	0.31	2,600	0.013	0.106	7,700	940
	Liquid	15	1.27	1.38	5200	0.88	0.96	110	100	0.051	0.42	2,600	0.0177	0.14	5,600	690
	Liquid (Spot)	19.3	1.63	1.78	5200	1.1	1.2	88	81	0.066	0.54	2,600	0.0228	0.19	4,400	540
mowing turf: adults	Granular	11	0.93	1.01	500	0.013	0.014	7,500	6,900	0.038	0.31	1,000	0.0011	0.0088	93,000	11,000
	Liquid	15	1.27	1.38	500	0.018	0.02	5,500	5,100	0.051	0.42	1,000	0.0015	0.012	68,000	8,400
	Liquid (Spot)	19.3	1.63	1.78	500	0.023	0.025	4,300	3,900	0.066	0.54	1,000	0.0019	0.015	53,000	6,500
mowing turf: preteen	Granular	11	0.93	1.01	500	0.024	0.026	4,200	3,800	0.038	0.31	1,000	0.0019	0.016	52,000	6,400
	Liquid	15	1.27	1.38	500	0.033	0.035	3,100	2,800	0.051	0.42	1,000	0.0026	0.021	38,000	4,700
	Liquid (Spot)	19.3	1.63	1.78	500	0.042	0.046	2,400	2,200	0.066	0.54	1,000	0.0034	0.028	30,000	3,600
golf course reentry: adult	Granular	11	0.93	1.01	500	0.027	0.029	3,800	3,500	0.038	0.31	500	0.0011	0.0088	93,000	11,000
	Liquid	15	1.27	1.38	500	0.036	0.039	2,800	2,500	0.051	0.42	500	0.0015	0.012	68,000	8,400
golf course reentry: youth 10-12	Granular	11	0.93	1.01	500	0.048	0.052	2,100	1,900	0.038	0.31	500	0.0019	0.016	52,000	6,400
	Liquid	15	1.27	1.38	500	0.065	0.071	1,500	1,400	0.051	0.42	500	0.0026	0.021	38,000	4,700

a TTR source: MRID # 450007-01 turf transferable residue study - see Table 8 for raw data and regression statistics. DAT 0 residue values were used for the short-term assessments and DAT 7 residue values were used for the intermediate-term assessments. The study was conducted in CA, GA and FL using an average application rate of 22 lb ai/acre for the combined CA/GA sites and 19 lb ai/acre for the PA site. When assessing activities involving a different application rate than was used in the study, the TTR values were adjusted proportionately to reflect the different application rates. For example for an application rate of 19.3 lb ai/acre :

normalized (adjusted) TTR = Turf study TTR x 19.3 lb ai/A assessed rate / 22 lb ai/A study rate.

b Transfer coefficient from the Residential SOP's (02/01).

c Dermal dose = normalized TTR (Fg/cm^2) x TC (cm^2/hr) x conversion factor (1 mg/1,000 Fg) x exposure time (2 hrs/day playing 7 mowing; 4 hrs golfing) / body weight (70 kg adult or 39 kg preteen or 15 kg child 1-6 yrs). Short term MOEs were calculated using DAT 0 residue values and intermediate term MOEs were calculated using DAT 7 residue values.

d MOE = NOAEL (100 mg/kg/day; based on a dermal study) / dermal dose

Note: TTR = turf transferable residue

DAT = days after treatment

Table 17b: Thiophanate-methyl: Postapplication Cancer Risk Estimates for Activities on Treated Turf (Thiophanate-methyl Residues Only)

Activity	Typical Application Rate (a)	Days of Exposure per Year (b)	CA/GA 14-day avg TTR, adjusted for "typical" rate (Fg/cm^2) (c)	PA 14-day avg TTR, adjusted for "typical" rate (Fg/cm^2) (c)	Transfer Coefficient (cm2/hr) (d)	CA/GA site Absorbed Dermal Daily Dose (mg/kg/day) (e)	PA site Absorbed Dermal Daily Dose (rounded) mg/kg/day (e)	CA/GA site LADD (mg/kg/day) (f)	PA site LADD (mg/kg/day) (f)	CA/GA site Cancer Risk (g)	PA site Cancer Risk (g)
High-contact activities	5.4	14	0.0560	0.173	7300	0.000817	0.0025	2.2E-05	6.9E-05	3.1E-07	9.6E-07
Mowing	5.4	2	0.0560	0.173	500	0.000112	0.00035	4.4E-07	1.4E-06	6.0E-09	1.9E-08
Golfing	5.4	5	0.0560	0.173	500	0.000112	0.00035	1.1E-06	3.4E-06	1.5E-08	4.7E-08

a Typical (not maximum) application rates were used to adjust TTR study residue data; rate confirmed per label and registrants' comments.

b Average or typical days per year for cancer risk estimates: Working/playing on lawn for 14 days after single annual application based on residue dissipation rate from TTR study; mowing based on weekly mowing during 2 weeks after single annual application; Golfing based on national average 18 days/year adjusted for 5 applications per season;

c TTR source: MRID # 450007-01 turf transferable residue study - see Table 8 for raw data and regression statistics. DAT 0 residue values were used for the short-term assessments and DAT 7 residue values were used for the intermediate-term assessments. The study was conducted in CA, GA and FL using an average application rate of 22 lb ai/acre for the combined CA/GA sites and 19 lb ai/acre for the PA site. When assessing activities involving a different application rate than was used in the study, the TTR values were adjusted proportionately to reflect the different application rates. For example for the "typical" application rate of 5.4 lb ai/acre :

normalized (adjusted) TTR = Turf study TTR x 5.4 lb ai/A assessed rate / 22 lb ai/A study rate.

d Transfer coefficient from the updated Residential SOP's (02/01).

e Absorbed daily dose = Average day 0-14 TTR (Fg/cm^2) x intermediate-term transfer coefficient (cm^2/hr) x mg/1,000 Fg x exposure duration (2 hrs/day for playing/gardening/mowing; 4 hrs/day to play golf) x dermal absorption factor (0.07) / body weight (70 kg adult).

f LADD = absorbed daily dose (mg/kg/day) x days of exposure/year x years of expected exposure/ (365 days/year x 70 year lifetime);

g Cancer Risk = LADD x Q_1^*, where $Q_1^* = 0.0138$ (mg/kg/day)$^{-1}$

TTR used for cancer risk estimate = 0-14 DAT average residue for each site normalized for application rate.

TTR = turf transferable residue

DAT = days after treatment

Table 18a. Thiophanate-methyl: Postapplication Non-Cancer Risk Estimates for Residential Harvesting of Treated Fruit (Thiophanate-methyl Residues Only)											
Exposure and Risk Estimates Based on DAT 0 Residues								Exposure and Risk Estimates Based on DAT 7 Residues			
Age group	Fruit	Application Rate (lb ai/acre)	Hours of Exposure (a)	NY Dermal Dose (mg/kg/day) (b)	WA Dermal Dose (mg/kg/day) (b)	NY MOE (c)	WA MOE (c)	NY Dermal Dose (mg/kg/day) (b)	WA Dermal Dose (mg/kg/day) (b)	NY MOE (c)	WA MOE (c)
Adult	pecans, strawberries, pears	0.7	0.67	0.21	0.15	480	660	0.056	0.13	1,800	760
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	0.67	0.3	0.22	330	460	0.080	0.19	1,300	530
	almonds	1.4	0.67	0.42	0.3	240	330	0.11	0.26	900	380
	peaches	1.6	0.67	0.48	0.35	210	290	0.13	0.30	780	330
Youth 10-12	pecans, strawberries, pears	0.7	0.33	0.093	0.067	1100	1500	0.025	0.058	4,100	1,700
	apples, apricots, cherries, nectarines, plums/prunes, grapes	1	0.33	0.13	0.096	750	1000	0.035	0.083	2,800	1,200
	almonds	1.4	0.33	0.19	0.13	540	740	0.049	0.12	2,000	860
	peaches	1.6	0.33	0.21	0.15	470	650	0.056	0.13	1,800	750

a Exposure duration from Residential SOP 4.2

b Dermal dose = normalized DFR (Fg/cm^2) x TC (10,000 cm^2/hr for adults; 5,000 cm^2/hr for child) x conversion factor (1 mg/1,000 Fg) x exposure time (0.67 hrs/day for adults; 0.33 hrs/day for child) / body weight (70 kg adult or 39 kg preteen). Short term doses were calculated using DAT 0 residue values and intermediate term doses were calculated using DAT 7 residue values.
DFR source: MRID # 4487630-01 dislodgeable foliar residue study conducted on apple leaves - see Table 9 for regression statistics, predicted residues for NY, and actual residue values for WA. DAT 0 residue values were used for the short-term assessments and DAT 7 residue values were used for the intermediate-term assessments. The study was conducted in WA and NY using an application rate of 1.0 lb ai/acre. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. For example, for peaches:
normalized (adjusted) DFR = study DFR x 1.6 lb ai/A assessed rate / 1.0 lb ai/A study application rate

c MOE = NOAEL (100 mg/kg/day)/ dermal dose

Note: DFR = dislodgeable foliar residue,
DAT = days after treatment

Table 18b. Thiophanate-methyl: Postapplication Cancer Risk Estimates for Residential Harvesting of Treated Fruit (Thiophanate-methyl Residues Only)													
	Exposure and Risk Estimates Based on DAT 0 Residues									Exposure and Risk Estimates Based on DAT 7 Residues			
Fruit	DFR (NY site) ug/cm2 DAT 0 (a)	DFR (WA Site) ug/cm2 DAT0 (a)	DFR (NY sites) ug/cm2 DAT 7 (a)	DFR (WA) ug/cm2 DAT 7 (a)	Typical Application Rate (b)	NY site LADD (mg/kg) (c)	WA site LADD (mg/kg) (c)	NY site Cancer Risk (d)	WA site Cancer Risk (d)	NY site LADD (mg/kg) (c)	WA site LADD (mg/kg) (c)	NY site Cancer Risk (d)	WA site Cancer Risk (d)
pecans, straw-berries, pears	3.14	2.27	0.833	1.97	0.6	1.2E-04	8.9E-05	1.7E-06	1.23E-06	3.28E-05	9.2E-05	4.5E-07	1.3E-06
apples, apricots, cherries, nectarines, plums/ prunes, grapes	3.14	2.27	0.833	1.97	1	2.1E-04	1.5E-04	2.84E-06	2.05E-06	5.46E-05	1.3E-04	7.5E-07	1.8E-06
almonds	3.14	2.27	0.833	1.97	1	2.1E-04	1.5E-04	2.84E-06	2.05E-06	5.46E-05	1.3E-04	7.5E-07	1.8E-06
peaches	3.14	2.27	0.833	1.97	1.3	2.7E-04	1.9E-04	3.69E-06	2.67E-06	7.21E-05	1.7E-04	1.0E-06	2.4E-06

a DFR source: MRID # 4487630-01 dislodgeable foliar residue study conducted on apple leaves - see Table 11 for regression statistics, predicted residues for NY, and actual residue values for WA. The study was conducted in WA and NY using an application rate of 1.0 lb ai/acre. The DFR values were adjusted proportionately to reflect the different application rates. For example for an application rate of 1.6 lb ai/acre : normalized (adjusted) DFR = study DFR x 1.6 lb ai/A assessed rate / 1.0 lb ai/A study application rate

b Typical application rate (when available) was used for the cancer assessment.

c LADD = absorbed daily dose (mg/kg/day) x anticipated days of exposure per year (5) x years of expected exposure (50) / (365 days/year x 70 year lifetime); where absorbed daily dose = DFR (Fg/cm ^{2}) x transfer coefficient (cm^2 /hr) x mg/1,000 Fg x exposure (0.67 hrs/day) x dermal absorption factor (0.07) / body weight (70 kg adult). Transfer coefficient (10,000 cm2/hr0 from the Residential SOP's (12/97).

d Thiophanate-methyl Cancer Risk Estimate = LADD x Q_1^*, where $Q_1^* = 0.0138$ (mg/kg/day)$^{-1}$

Note: DFR = dislodgeable foliar residue,
DAT = days after treatment
Bolded numbers indicate cancer risk estimates < 10^{-6}.

Table 19: Residential Postapplication Short Term Dermal and Cancer Risk Estimates for Activities on Turf
Using MBC Residue Data from Thiophanate-methyl Turf Study

Scenario	Maximum Application Rate (lb ai/acre)	Exposure (hrs/day)	Short-term Dermal Risks - (Maximum residue data)							Adult MBC Cancer Risks[e]			
			Maximum MBC TTR (ug/cm[a]) normalized		MBC Short-term MOEs[c]								
						CA/GA		PA					
			CA/GA DAT 0	PA DAT 0	Transfer Coefficient (cm^2/hr)[b]	Dermal Dose (mg/kg/ day)	MOE	Dermal Dose (mg/kg/ day)	MOE	Typical Application Rate (lb ai/acre)	Exposure duration[d]	CA/GA Cancer Risks	PA Cancer Risks
(1a) Adult - high contact lawn activities	11 (granular)	2	0.035	0.041	14,500	0.017	17,000	0.020	15,000	5.4	14 days 50 years	4.4e-09	6.7e-09
	19.3 (liquid)		0.061	0.071		0.030	9,600	0.034	8,300	19.3 (max)		**1.6e-08**	**2.4e-08**
(1b) Child - high contact lawn activities	11	2	0.035	0.041	5,200	0.024	12,000	0.028	10,000	NA			
	19.3		0.061	0.071		0.043	6,700	0.049	5,800				
(2a) Adult - mowing turf	11	2	0.035	0.041	500	5.8e-04	490,000	6.8e-04	420,000	5.4	2 days 50 years	8.7e-11	1.3e-10
	19.3		0.061	0.071		0.0010	280,000	0.0012	240,000	19.3 (max)		**3.1e-10**	**4.7e-10**
(2b) Preteen - mowing turf	11	2	0.035	0.041	500	9.0e-04	320,000	0.0010	280,000	NA			
	19.3		0.061	0.071		0.0016	180,000	0.0018	160,000				
(3a) Adult - golf course reentry	11	4	0.035	0.041	500	0.0012	240,000	0.0014	210,000	5.4	5 days 50 years	2.2e-10	3.3e-10
	15 (liquid)		0.048	0.055		0.0016	180,000	0.0018	160,000	15 (max)		**6.0e-10**	**9.0e-10**
(3b) Preteen - golf course reentry	11	4	0.035	0.041	500	0.0018	160,000	0.0021	140,000	NA			
	15 (liquid)		0.048	0.055		0.0024	120,000	0.0028	100,000				

Footnotes:

NOTE: Only short-term risks are assessed for postapplication exposure to MBC from turf as turf study data showed low residues at seven days and no detectable residues thereafter.

a TTR source: MRID # 450007-01 turf transferable residue study - see study review for raw data and regression statistics. Maximum MBC residues detected during the sampling period of the study were used for both short and intermediate -term assessments. The study was conducted in CA and GA using an average application rate of 22 lb ai/acre for the combined CA/GA sites and 19 lb ai/acre for the PA site. When assessing activities involving a different application rate than was used in the study, the TTR values were adjusted proportionately to reflect different application rates. For example for a ready-to-use spray application rate of 19.3 lb ai/acre : normalized (adjusted) TTR = Turf study TTR x 19.3 lb ai/A assessed rate / 22 lb ai/A study rate. Max label rate for liquids 19.3 lb ai/acre on lawns; 15 lb ai/acre on turf; granular label max 11 lb ai/acre; typical rate per registrant of 5.4 lb ai/acre (label rate for existing turf)

b Transfer coefficient from proposed changes to the Residential SOP's (1999-2000).

c Dermal dose = TTR normalized to represent use of maximum application rate (Fg/cm^2) x TC (cm^2/hr) x conversion factor (1 mg/1,000 Fg) x exposure time (hrs/day) x dermal absorption factor (0.035) / body weight (60 kg female>13 yrs or 39 kg preteen or 15 kg child 1-6 yrs). DAT 0 residue values were used for short term and DAT 7 residue levels were used intermediate-term assessments. MOE = Oral NOAEL (10 mg/kg/day) / absorbed dermal dose (dermal dose x dermal absorption factor of 0.035)

d Exposure days = number of days expected exposure per year and number of years of expected exposure.

e Cancer Risk = LADD x Q_1^*, where Q_1^* = 0.00239 and LADD = absorbed daily dose (mg/kg/day) x days of exposure/year x years of expected exposure/ (365 days/year x 70 year lifetime); where absorbed daily dose = TTR normalized to represent use of the typical application rate (Fg/cm^2) x intermediate-term transfer coefficient (7300cm^2/hr) x mg/1,000 Fg x exposure (hrs/day) x dermal absorption factor (0.035) / body weight (70 kg adult).

Note: TTR = turf transferable residue
DAT = days after treatment

Table 20: Residential Postapplication Short Term Dermal and Cancer Risk Estimates for Harvesting Activities Using MBC Residue Data from Thiophanate-methyl Apple Study

			MBC Short-term Risks - (maximum residue data)							MBC Cancer Risks (DFR adjusted for typical rates)			
			MBC Maximum DFR[a] (ug/cm[a]) normalized if applicable			NY		WA					
Scenario	Scenario #	Exposure (hrs/day)	NY DAT 0	WA DAT 0	Transfer[b] Coefficient (cm^2/hr)	Dermal Dose (mg/kg/day)[c]	MOE[d]	Dermal Dose (mg/kg/day)[c]	MOE[d]	Typical Application Rate[e] (lb ai/acre)	Exposure days[f] .	NY Cancer Risk[g]	WA Cancer Risk[g]
Adult - harvesting fruit	1	0.67	0.16	0.27	10,000	0.018	16,000	0.030	9,400	0.6	5 days 50 years	1.1e-08	2.1e-08
	2		0.23	0.39		0.026	11,000	0.044	6,600	1	5 days 50 years	1.8e-08	3.6e-08
	3		0.32	0.55		0.036	7,900	0.061	4,700	1	5 days 50 years	1.8e-08	3.6e-08
	4		0.37	0.62		0.041	7,000	0.069	4,100	1.3	5 days 50 years	2.3e-08	4.6e-08
Preteen - harvesting fruit	1	0.33	0.16	0.27	5,000	6.8e-03	42,000	0.012	25,000	-	-	-	-
	2		0.23	0.39		0.010	29,000	0.017	17,000	-	-	-	-
	3		0.32	0.55		0.014	21,000	0.023	12,000	-	-	-	-
	4		0.37	0.62		0.016	18,000	0.026	11,000	-	-	-	-

Footnotes:

Scenario	Application Rates (lb ai/acre)	Fruits/nuts
1	0.7	pecans, strawberries, pears
2	1	apples, apricots, cherries, nectarines, plums/prunes, grapes
3	1.4	almonds
4	1.6	peaches

a MBC DFR source: MRID # 4487630-01 dislodgeable foliar residue study conducted on apple leaves - see study review for regression statistics, predicted residues for NY, and actual residue values for WA. The study was conducted in WA and NY using an application rate of 1.0 lb ai/acre. The maximum MBC residues detected during the sampling period of the study were used in this assessment. When assessing activities involving a different application rate than was used in the study, the DFR values were adjusted proportionately to reflect the different application rates. For example for an application rate of 1.6 lb ai/acre :
normalized (adjusted) DFR = study DFR x 1.6 lb ai/A assessed rate / 1.0 lb ai/A study application rate

b Transfer coefficient from the Residential SOP's (12/97).

c Dermal dose = normalized DFR (Fg/cm^2) x TC (cm^2/hr) x conversion factor (1 mg/1,000 Fg) x exposure time (hrs/day) / body weight (60 kg female >13 yrs or 39 kg preteen).

d MOE = Oral NOAEL (10 mg/kg/day) / absorbed dermal dose [where absorbed dermal dose = dermal dose x dermal absorption factor (0.035)]

e Typical application rate (when available) was used for the cancer assessment.

f Exposure days = number of days expected exposure per year and number of years of expected exposure.

g MBC Cancer Risk = LADD x Q_1^*, where Q_1^* = 0.00239 and LADD = absorbed daily dose (mg/kg/day) x days of exposure/year x years of expected exposure/ (365 days/year x 70 year lifetime); where absorbed daily dose = DFR (Fg/cm^2) x transfer coefficient (cm^2 /hr) x mg/1,000 Fg x exposure (hrs/day) x dermal absorption factor (0.035) / body weight (70 kg adult).

Note: DFR = dislodgeable foliar residue,
DAT = days after treatment

Table 21a: Residential Oral Nondietary Short-term Postapplication Risks to Children from "Hand-to-Mouth" and Ingestion Exposure When Reentering Lawns Treated with Thiophanate Methyl: Thiophanate-methyl Residues Only					
Type of Exposure		Oral Dose[a] (mg/kg/day)		MOE[b]	
		Liquid (Ready-to-Use)	Granular Formulation	Liquid (Ready-to-Use)	Granular Formulation
(1) Hand to Mouth Activity		0.29	0.16	35	61
(2) Incidental Turfgrass Mouthing		0.072	0.041	140	240
(3) Incidental Ingestion of Soil		0.00097	0.00055	**10,000**	**18,000**
(4) Ingestion of Granules	1.6% ai	NA	0.32	NA	31
	5.5% ai		1.1		9
Aggregate Oral Nondietary (except granular ingestion)[c]		0.36	0.20	28	50
Aggregate Oral and Dermal[d]		NA	NA	21	37

NA = Not applicable to this scenario
BOLD = MOE greater than target MOE of 300
Footnotes:

a Application rates represent maximum label rates from current EPA registered labels: Scotts 538-253 ready to use formulation for liquid application, max rate = 19.3 lb ai/acre; for all granular product formulations, max rate is 11 lb ai/acre. Given that dislodgeable foliar residues for thiophanate-methyl were not available, incidental oral doses were calculated using formulas presented in the Residential SOPs (updated 1999-2000). Short-term doses were calculated using the following formulas:
(1) Hand-to-mouth oral dose to children on the day of treatment (mg/kg/day**)** = [application rate (lb ai/acre) x fraction of residue dislodgeable from potentially wet hands (5%) x 11.2 (conversion factor to convert lb ai/acre to Fg/cm^2)] x median surface area for 1-3 fingers (20 cm^2/event) x hand-to-mouth rate (20 events/hour) x exposure time (2 hr/day) x 0.001 mg/µg] x 50% extraction by saliva / bw (15 kg child 1-6 yrs). This formula is based on proposed changes to the December 1999 Residential SOPs.
(2) Turf mouthing oral dose to child on the day of treatment (mg/kg/day) = [application rate (lb ai/acre) x fraction of residue dislodgeable from potentially wet hands (20%) x 11.2 (conversion factor to convert lb ai/acre to Fg/cm^2) x ingestion rate of grass (25 cm^2/day) x .001 mg/µg] / bw (15 kg child 1-6 yrs).
Soil ingestion oral dose to child on the day of treatment (mg/kg/day) = [(application rate (lb ai/acre) x fraction of residue retained on uppermost 1 cm of soil (100% or 1.0/cm) x 4.54e+08 Fg/lb conversion factor x 2.47e-08 acre/cm^2 conversion factor x 0.67 cm^3/g soil conversion factor) x 100 mg/day ingestion rate x 1.0e-06 g/Fg conversion factor] / bw (15 kg; child 1-6 yrs). Short term dose based residue on the soil on day of application.
Granular pellet ingestion (mg/kg/day) oral dose to child = [granule ingestion rate (300 mg/day) x fraction of ai of granule formulations] / bw (15 kg child 1-6 yrs).

b MOE = NOAEL (10 mg/kg/day for both short- and intermediate-term assessments) / Oral Dose (mg/kg/day). NOAEL determined from a developmental rabbit study.

c Aggregate MOEs = NOAEL / [sum of incidental oral doses] with an target MOE of 300.

d Aggregate Dermal + Incidental Oral MOEs = 1/ [$1/MOE_{dermal}$ + $1/MOE_{oral}$]; see Table 15a for dermal MOEs for high-contact short-term activity on turf (liquid MOE = 81; granular MOE = 140).

Table 21b. Residential Oral Nondietary Short-term Postapplication Risks to Children from "Hand-to-Mouth" and Ingestion Exposure When Reentering Lawns Treated with Thiophanate Methyl: MBC Residues Only

Type of Exposure		Data Source and Assumptions	Oral Dose (mg/kg/day)	MOE[a]
(1) Hand to Mouth Activity (Finger licking)		SOP 2.3.2: Proportion of MBC TTR to total at DAT 0 was used to adapt Residential SOP (2/01): 5% DFR x (.07/1.86 % max fraction MBC) x 0.395 Fg/cm^2 x surface area of 3 fingers (20 cm^2) x 20 events/hr x 50% saliva extraction factor x 2 hrs/day x 0.001 ug/mg / body weight (15 kg child 1-6 yrs) = oral dose.	0.011	910
(2) Incidental Turfgrass Mouthing		SOP 2.3.3: Proportion of MBC TTR to total at DAT 0 was used to adapt Residential SOP (02/01): Oral dose = 20% DFR x (0.07/1.86 = max fraction MBC) x Tc (25 cm^2/day of turf grass mouthed) x 0.395 Fg/cm^2 x 0.001 ug/mg / 15 kg body weight.	0.00064	15,000
(3) Incidental Ingestion of Soil		Insufficient Data on MBC	NA	NA
(4) Ingestion of Granules	1.6% ai	No MBC exposure anticipated by this scenario		
	5.5% ai			
Aggregate Oral Nondietary [b]		Sum of Scenarios 1-4	0.011	910
Aggregate Oral and Dermal[c]		Oral + High contact activity on lawn (Table 15c)	0.0017 + 0.011 = 0.013	790

NA = Not applicable to this scenario

Footnotes:

a MOE = NOAEL (10 mg/kg/day for both short- and intermediate-term assessments) / Oral Dose (mg/kg/day).
b Aggregate MOEs = NOAEL / [sum of incidental oral doses] with an target MOE of 1000.
c Aggregate Dermal + Incidental Oral MOEs = NOAEL (10 mg/kg/day) / sum of [dermal x 3.5% absorption] & oral doses; see Table 19 for dermal MOEs for high-contact short-term activity on turf. Target MOE 1000.

Table 22. Occupational Exposure Scenario Descriptions, Assumptions and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions**	**Comments**
Occupational Mixer/Loader Exposure			
Mixing/Loading Wettable Powder Formulations (1a, 1b, 1c, 1d., 1e)	PHED V1.1	1,200, 350, 80 acres for aerial/ chemigation and 5 acres for soil drench chemigation; 200, 80 and 40 acres by groundboom; 5 acres for soil directed drench application to ornamentals; 40 (crops) and 20 (ornamentals) acres for airblast; 100 acres(M/L for 20 trucks capable of treating 5 acres each) and 1 acre for soil directed drench application to ornamentals both for lawn handgun application and 100 gallons for dip treatment	**Baseline:** "Best Available" grades: Dermal (22-35 replicates), ABC grade. Hand (7 replicates), ABC grade. Inhalation (44 replicates), ABC grade. Low confidence in dermal/ hand data due to the low number of hand replicates; medium confidence in inhalation data. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Gloved hand (24 replicates) are based on ABC grade data. Medium confidence in dermal/gloved hands data. **Engineering Controls (water soluble packets):** Hand (5 replicates) and dermal (6-15 replicates) exposure values are based on AB grade data. Inhalation (15 replicates) exposure value is based on all grade data. Low confidence in dermal/hand and inhalation data.
Mixing/Loading Dry Flowable Formulations (2a, 2b, 2c, 2d, 2e)	PHED V1.1	1,200, 350,80 acres for aerial/chemigation and 5 acres for soil drench chemigation; 200, 80 and 40 acres and 5 acres for soil directed drench application to ornamentals all by groundboom; 40 and 20 acres for airblast; 100 acres(M/L for 20 trucks capable of treating 5 acres each) and 1 acre for soil directed drench application to ornamentals both for lawn handgun application and 100 gallons for dip treatment	**Baseline:** Dermal (16-26 replicates); hand (7 replicates); and inhalation (23 replicates) exposure values are all based on AB grade data. Low confidence in hand/dermal data due to the low number of hand replicates. High confidence inhalation data. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Hand (21 replicates) exposure values are based on AB grade data. High confidence in the dermal/gloved hands data. **Engineering Controls (water soluble packets):** Hand (5 replicates) and dermal (6-15 replicates) exposure values are based on AB grade data. Inhalation (15 replicates) exposure value is based on all grade data. Low confidence in dermal/hand and inhalation data.
Mixing/Loading Liquid Formulations (3a, 3b, 3c, 3d., 3e)	PHED V1.1	1,200, 350, 80 acres for aerial/chemigation and 5 acres soil drench chemigation; 200, 80 and 40 acres and 5 acres for soil directed drench application to ornamentals all by groundboom; 40 and 20 acres for airblast; 100 acres(M/L for 20 trucks capable of treating 5 acres each) and 1 acre for soil directed drench application to ornamentals both for lawn handgun application and 100 gallons for dip treatment	**Baseline:** Dermal (172-122 replicates); hand (53 replicates); and inhalation (85 replicates) exposure values are all based on AB grade data. High confidence in dermal/hands and inhalation data. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (59 replicates) exposure value is based on is based on AB grade data. High confidence in the unit dermal/gloved-hand exposure value. **Engineering Controls: (closed mixing systems):** Dermal (31 replicates), hand (31 replicates), and inhalation (27 replicates) exposure values are based on AB grade data. High confidence in the dermal/gloved hand and inhalation unit exposure values. Empirical data include the use of chemical-resistant gloves.
Loading Granular Formulations (3)	PHED V1.1	350 acres for ornamental aerial applications, 80 acres for sod farms and 40 acres for golf course turf	**Baseline:** Hand (10 replicates) exposure values are based on all grade data, dermal (33-78) exposure values are based on ABC grade data , and inhalation (58 replicates) exposure values are based on AB grade data. Low confidence in dermal/hand data and high confidence in inhalation data. **PPE:** The same inhalation data are used as for the baseline coupled with an 80% protection factor to account for the use of a dust/mist respirator. Hand (45 replicates) and double layer (12-59 replicates) exposure values are based on ABC grade data. Medium confidence in single-layer/gloved hand data and low confidence in double-layer/ gloved hand data. **Engineering Controls (Lock 'n Load):** The same data are used as for baseline coupled with a 98% protection factor to account for Lock 'n Load.

Table 22. Occupational Exposure Scenario Descriptions, Assumptions and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions**	**Comments**
Loading Dusts (5)	Stevens and Davis (1980)	20 acres (USDA)	Published study using captan dust as surrogate: Loaders pouring dust formulation into seed hoppers of potato seed piece dusting machines. In the study, dermal exposure monitoring was limited to the hands, face, and neck, based on the assumption that handlers normally wear long-sleeved shirts or jackets and long pants, during cool weather in the early spring when these operations are conducted. Hand exposure was monitored for the handlers filling the seed hoppers with captan because these handlers wore canvas-backed leather gloves. Inhalation exposure monitoring was also conducted. (See review in text of RED).
Occupational Applicator Exposure			
Aerial Spray Application (6)	PHED V1.1	1,200, 350 and 80 acres	**Baseline and PPE:** insufficient data. **Engineering controls (enclosed cockpit):** Dermal (24 to 48 replicates) and inhalation (23 replicates) exposure values are based on ABC grade data. Hand (34 replicates) exposure value is based on AB grade data. Medium confidence in the dermal/hands and inhalation unit exposure values.
Aerial Granular Application (7)	PHED V1.1	80 acres for ornamental crops	**Baseline and PPE:** insufficient data. **Engineering controls (enclosed cockpit):** Dermal (0-13 replicates) exposure values are based on C grade data. Hand (4 replicates) and inhalation (13 replicates) exposure values are based on all grade data. Low confidence in the dermal/hands and inhalation unit exposure values.
Groundboom Application (8)	PHED V1.1	200, 80, 40 and 5 acres	**Baseline:** Dermal (23 to 42 replicates), hand (29 replicates), and inhalation (22 replicates) exposure values are based on AB grade data. High confidence in the unit exposure values. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, if needed, with a 50% protection factor to account for an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (21 replicates) exposure value is based on ABC grade data. Medium confidence in the dermal/gloved hand unit exposure value. **Engineering Controls (enclosed cab):** Dermal (20 to 31 replicates) and hand (16 replicates) exposure values are based on ABC grade data. Inhalation (16 replicates) exposure value is based on AB grade data. Medium confidence in dermal/hand unit exposure value, and high confidence in the inhalation unit exposure value.
Applying with an Airblast Sprayer (9)	PHED V1.1	40 and 20 acres	**Baseline:** Dermal (32-49 replicates), hands (22 replicates), and inhalation (47 replicates) exposure values are based on AB grades. High confidence in the unit exposure values. **PPE**: The same dermal and inhalation data are used as for the baseline coupled, if needed, with a 50% protection factor to account for an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (18 replicates) exposure value is based on AB grade data. High confidence in the dermal/gloved hand unit exposure value. **Engineering Controls (enclosed cab)**: Dermal (20-30) replicates are based on AB grades, inhalation (9 replicates) are based on ABC grades, and hand (0 replicates). Low confidence in dermal/hand and inhalation data.
Applying Liquids with a Handgun (10)	ORETF Study OMA002 MRID 449722-01	5 acres, and 0.05 acres for soil drench application	**Baseline:** Dermal inner and outer dosimeters, inhalation, and gloved hand 30 replicates. Ungloved dose determined using 90% PF. All AB grade data, high confidence. **PPE:** Gloved hand 30 replicates. Inner dosimeters 30 replicates, no PF required to calculate. The same inhalation data are used as for the baseline coupled with an 80% protection factor to account for the use of a dust/mist respirator. **Engineering Controls:** Not available for this scenario

Table 22. Occupational Exposure Scenario Descriptions, Assumptions and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions**	**Comments**
Applying Granulars with a Tractor Drawn Spreader (11)	PHED V1.1	40 acres	**Baseline:** Dermal (1-5 replicates); hand (5 replicates); and inhalation (5 replicates) exposure values are all based on AB grade data. Low confidence in the unit exposure values. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. **Gloved-hand (0 replicates) exposure value is low confidence due to lack of data.** **Engineering Controls: (enclosed cab):** Dermal (2-30 replicates), gloved hand (24 replicates), and inhalation (37 replicates) exposure values are based on AB grade data. High confidence in the dermal/gloved hand unit exposure value. Low confidence in inhalation unit exposure value.
Applying a Dip Treatment (12)	No data	100 gallons	No data
Applying Dust as a Potato Seed Treatment (13)	Stevens and Davis (1981)	30 acres	Published study using captan as surrogate. Low confidence. Handlers cutting and sorting the treated potato seed pieces, operators of potato seed piece planters, and observers involved in the planting operations were monitored. Dermal exposure monitoring was limited to the hands, face, and neck, based on the assumption that handlers normally wear long-sleeved shirts or jackets and long pants. Hand exposure was not monitored for the handlers cutting and sorting the potato seed pieces, because they wore rubber gloves. Inhalation exposure monitoring was conducted. (See text of RED for review of study.)
Occupational Mixer/Loader/Applicator Exposure			
Liquids Using a High Pressure Handwand (14)	PHED V1.1	1,000 gallons	**Baseline:** Inhalation (13 replicates) exposure values are based on A grade data. Low confidence in inhalation data. **PPE:** The same inhalation data are used as for the baseline coupled, when needed, with an 80% protection factor to account for the use of a dust/mist respirator. Dermal (7 to 13 replicates) are based on AB grade data and gloved hand (7 to 13 replicates) is based on ABC grade data. Low confidence in the unit exposure value for dermal/gloved hands. Dermal data is coupled, when needed, with a 50% protection factor to account for an additional layer of clothing. **Engineering Controls:** Not considered plausible for this assessment.
Wettable Powders with a Low Pressure Handwand (15)	PHED V1.1	0.5 acres or 40 gallons	**Baseline**: Inhalation data (16 replicates) are based on ABC grade data. Medium confidence in inhalation data. **PPE:** The same inhalation data are used as for the baseline coupled, when needed, with an 80% protection factor to account for the use of a dust/mist respirator. Dermal (16 replicates) data are based on ABC grade data and gloved hand (15 replicates) data are based on AB grade data. Medium Confidence in dermal/gloved hand data. Dermal data is coupled, when needed, with a 50% protection factor to account for an additional layer of clothing. **Engineering controls**: Not feasible for this assessment.
Low Pressure Handwand - Liquid Formulation (16)	PHED V1.1	0.5 acres or 40 gallons	**Baseline:** Dermal (9 to 80 replicates) and inhalation (80 replicates) exposure values are based on ABC grade data. Hand (70 replicates) exposure value is based on all grade data. Low confidence in the dermal/ hands unit exposure values. Medium confidence in the inhalation unit exposure value. **PPE:** The same dermal and inhalation data are used as for baseline coupled, if needed, with a 50% protection factor to account for the use of an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. Gloved hand (10 replicates) exposure value is based on ABC grade data. Low confidence in dermal/gloved hand data. **Engineering Controls:** Not available for this assessment.
Dry Flowables with a Low Pressure Handwand (17)	No data	0.5 acres or 40 gallons	No data

Table 22. Occupational Exposure Scenario Descriptions, Assumptions and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions**	**Comments**
Backpack Sprayer - Liquid Formulation (18)	PHED V1.1	5 acres, and 0.05 acres for soil drench application	**Baseline:** Inhalation (11 replicates) exposure value is based on A grade data. Low confidence in the unit exposure value. No protection factors were needed to define the unit exposure value. **PPE:** Hand (11 replicates) exposure value data is based on C grade data. Dermal (9-11 replicates) exposure value is based on AB grade data. Low confidence in gloved hand/dermal data. Dermal data is coupled, when needed, with a 50% protection factor to account for an additional layer of clothing. The same inhalation data are used as for the baseline coupled with an 80% protection factor to account for the use of a dust/mist respirator. **Engineering Controls:** Not available for this assessment.
Mixing/Loading/Applying with a Lawn Handgun - Liquid Formulations (PCO) (19)	ORETF Study OMA002 MRID 449722-01	5 acres and 0.05 acres 5 acres	**Baseline**: Inhalation (15 replicates) data were used to establish exposure values. **PPE**: The same inhalation data are used as for baseline coupled, if needed, with an 80% protection factor to account for the use of a dust/mist respirator. Dermal (15 replicates) and gloved hand (60 replicates) data were used to establish an exposure value. The dermal data are coupled, if needed, with a 50% protection factor to account for the use of an additional layer of clothing. **Engineering Controls**: Not available for this scenario.
Mixing/Loading/Applying with a Lawn Handgun -Dry Flowable Formulations (PCO) (19c)	ORETF Study OMA002 MRID 449722-01	5 acres and 0.05 acres 5 acres	**Baseline**: Inhalation (15 replicates) data were used to establish exposure values. **PPE**: The same inhalation data are used as for baseline coupled, if needed, with an 80% protection factor to account for the use of a dust/mist respirator. Dermal (15 replicates) and gloved hand (60 replicates) data were used to establish an exposure value. The dermal data are coupled, if needed, with a 50% protection factor to account for the use of an additional layer of clothing. **Engineering Controls**: Not available for this scenario.
Mixing/Loading/Applying with a Lawn Handgun - Wettable Powder Formulations (PCO) (19d)	ORETF Study OMA002 MRID 449722-01	5 acres and 0.05 acres 5 acres	Baseline: Inhalation (15 replicates) data were used to establish exposure values. **PPE**: The same inhalation data are used as for baseline coupled, if needed, with an 80% protection factor to account for the use of a dust/mist respirator. Dermal (15 replicates) and gloved hand (60 replicates) data were used to establish an exposure value. The dermal data are coupled, if needed, with a 50% protection factor to account for the use of an additional layer of clothing. **Engineering Controls**: Not available for this scenario.
Loading and Applying to Turf with a Bellygrinder (20)	PHED V1.1	1 acre	**Baseline:** Dermal (29-45 replicates); hand (23 replicates) exposure values based on ABC grade data. Inhalation (40 replicates) exposure value is based on AB grade data. Medium confidence in dermal/hand data and high confidence in the inhalation unit exposure value. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (20 replicates) exposure value is based on all grade data. Low confidence in dermal/gloved hand data. **Engineering Controls:** Not available for this scenario.

Table 22. Occupational Exposure Scenario Descriptions, Assumptions and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions**	**Comments**
Loading and Applying Granulars with a Push Type Spreader (PCO) (21a)	PHED V1.1	5 acres	**Baseline:** Dermal (0-15 replicates) and hand (55 replicates) exposure values based on C grade data. Inhalation (15 replicates) exposure value is based on B grade data. Low confidence in dermal/hand data and high confidence in the inhalation unit exposure values. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (0 replicates) exposure value is low confidence due to lack of gloved hand data. **Engineering Controls:** Not available for this scenario.
Loading and Applying Granulars with a Push Type Spreader (PCO) (21b)	ORETF Study OMA001	5 acres	**Baseline**: Hand (20 replicates), dermal (40 replicates) and inhalation (40 replicates) data were used to establish unit exposure values. **PPE**: The same dermal and inhalation data are used as for the baseline coupled, when needed, with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (20 replicates) data used to establish exposure value. **Engineering Controls**: Not available for this scenario.
Loading/Applying Dust as a Seed Treatment (dry) in Planter Box (22)	Fenske et al., 1990	20 acres (USDA)	Surrogate data from Lindane study. All data were for single layer plus gloved hands; respiratory exposure 0.02% of dose and therefore, negligible. Seed treatment only, not planting; 60 replicates (see study review in text).
Mixing/Loading/Applying a Dip Treatment (23)	No data	100 gallons	No data
Occupational Flagger Exposure			
Flagging Aerial Sprays (24)	PHED V1.1	1,200, 350, and 80 acres	**Baseline:** Dermal (18 to 28 replicates); hand (30 replicates); and inhalation (28 replicates) exposure values are based on AB grade data. High confidence in the unit exposure values. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, if needed, with a 50% protection factor to account for the use of an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. Hand (6 replicates) exposure value is based on AB grade data (not used). Low confidence in the gloved hand unit exposure value. **Engineering Controls (enclosed cab):** Data is based on groundboom enclosed cab.
Flagging Aerial Granular Applications (25)	PHED V1.1	80 acres	**Baseline**: Inhalation (4 replicates) based on E grade data. Low confidence in inhalation data. No dermal or hand data. **PPE**: The same inhalation data are used as for the baseline coupled, if needed, with an 80% protection factor to account for the use of a dust/mist respirator. No dermal or gloved hand data. **Engineering Controls (enclosed cab):** Data is based on ground spreader enclosed cab.

[a] Standard assumptions are based on the activities of a typical individual over a daily 8 hour interval. Occupational scenarios reflect what individuals could accomplish in an 8 hour workday.

[b] Data quality assessments are based on the PHED grading criteria and the guidance provided in the Dec 1997 surrogate exposure table. Acceptable grades are matrices with grade A and/or B data. The PHED surrogate exposure table upon which this assessment is based was developed using the best data available in the system that are appropriate to the exposure scenario. Data confidence descriptors are assigned as follows:

High = grades A and B and 15 or more replicates;
Medium = grades A, B, and C and 15 or more replicates; and
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates

Table 23. Residential Exposure Scenario Descriptions, Assumptions, and Data Sources for the Use of Thiophanate Methyl			
Exposure Scenario (Number)	**Data Source**	**Standard Assumptions[a]**	**Comments[b]**
Applying RTU Formulation with a Hose-End Sprayer (1a), and Mixing and Applying Liquid Formulation with a Hose-end Sprayer (1b)	ORETF Study OMA004 MRID 449722-01	0.5 acres - turf; or turf spot treatment to 0.025 acres (1,000 ft^2) 0.25 acres - ornamentals [max 4 quarts]	**Baseline:** Dermal, hand and inhalation (30 replicates each) data used to establish exposure values. Average laboratory and field recoveries were within guideline parameters; data of acceptable quality (AB grade).
Mixing/Loading/Applying with a Low Pressure Handwand - Wettable Powder Formulations (2)	SOPs for Residential Exposure Assessments (12/97)	5 gallons- ornamentals; or turf spot treatment to 0.025 acres (1,000 ft^2)	**Baseline**: Dermal, and inhalation (16 replicates) exposure values are based on C grade data, and hand (15 replicates) exposure values are based on A grade data. Low/medium confidence in hand/dermal data. Medium confidence in inhalation data. "No gloved" hand exposure was back calculated applying a 90 percent protection factor to "gloved" hand exposure data; therefore a 10x FQPA safety factor has been applied to the hand exposure.
Mixing/Loading/Applying with a Low Pressure Handwand - Liquid Formulations (3)	SOPs for Residential Exposure Assessments (12/97)	5 gallons- ornamentals; or turf spot treatment to 0.025 acres (1,000 ft^2)	**Baseline**: Dermal (9-80 replicates) and inhalation (80 replicates) exposure values ares based on ABC grade data, and hand (70 replicates) exposure value is based on All grade data. Low confidence in hand/dermal data. Medium confidence in inhalation data.
Mixing/Loading/Applying with a Backpack Sprayer (4)	SOPs for Residential Exposure Assessments (12/97)	5 gallons- ornamentals; or turf spot treatment to 0.025 acres (1,000 ft^2)	**Baseline:** Dermal (9-11 replicates) exposure value is based on AB grade data, hand (11 replicates) exposure value is based on C grade data, and inhalation (11 replicates) exposure value is based on A grade data. Low confidence in hands/dermal and inhalation data. A 90% protection factor was used to "back calculate" the "no glove" hand scenario from gloved hand data.
Loading/Applying with a Push-type Granular Spreader (5b)	ORETF Study - OMA003 MRID 449722-01	0.5 acres	**Baseline:** Hand, dermal, and inhalation (30 replicates each) data used to establish exposure values. Average laboratory and field recoveries were within guideline parameters; data of acceptable quality (AB grade).
Loading/Applying Granulars with a Bellygrinder (6)	SOPs for Residential Exposure Assessments (12/97)	0.025 acres (1,000 ft^2) for spot treatment	**Baseline:** Dermal (20-45 replicates) and hand (23 replicates) exposure values are based on ABC grade data. Inhalation (40 replicates) exposure value is based on AB grade data. Medium confidence in dermal/hand data and high confidence in inhalation data.
Applying Granulars by Hand (7)	SOPs for Residential Exposure Assessments (12/97)	0.025 acres (1,000 ft^2) for spot treatment	**Baseline:** Dermal. hand, inhalation (each 16 replicates) exposure values are based on ABC grade data. Medium confidence in all data. "No gloved" hand exposure was back calculated applying a 90 percent protection factor to "gloved" hand exposure data; therefore a 10x FQPA safety factor has been applied to the hand exposure.

[a] Standard Assumptions based on HED estimates.

[b] "Best Available" grades are defined by HED SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D and E or any combination of grades with less than 15 replicates